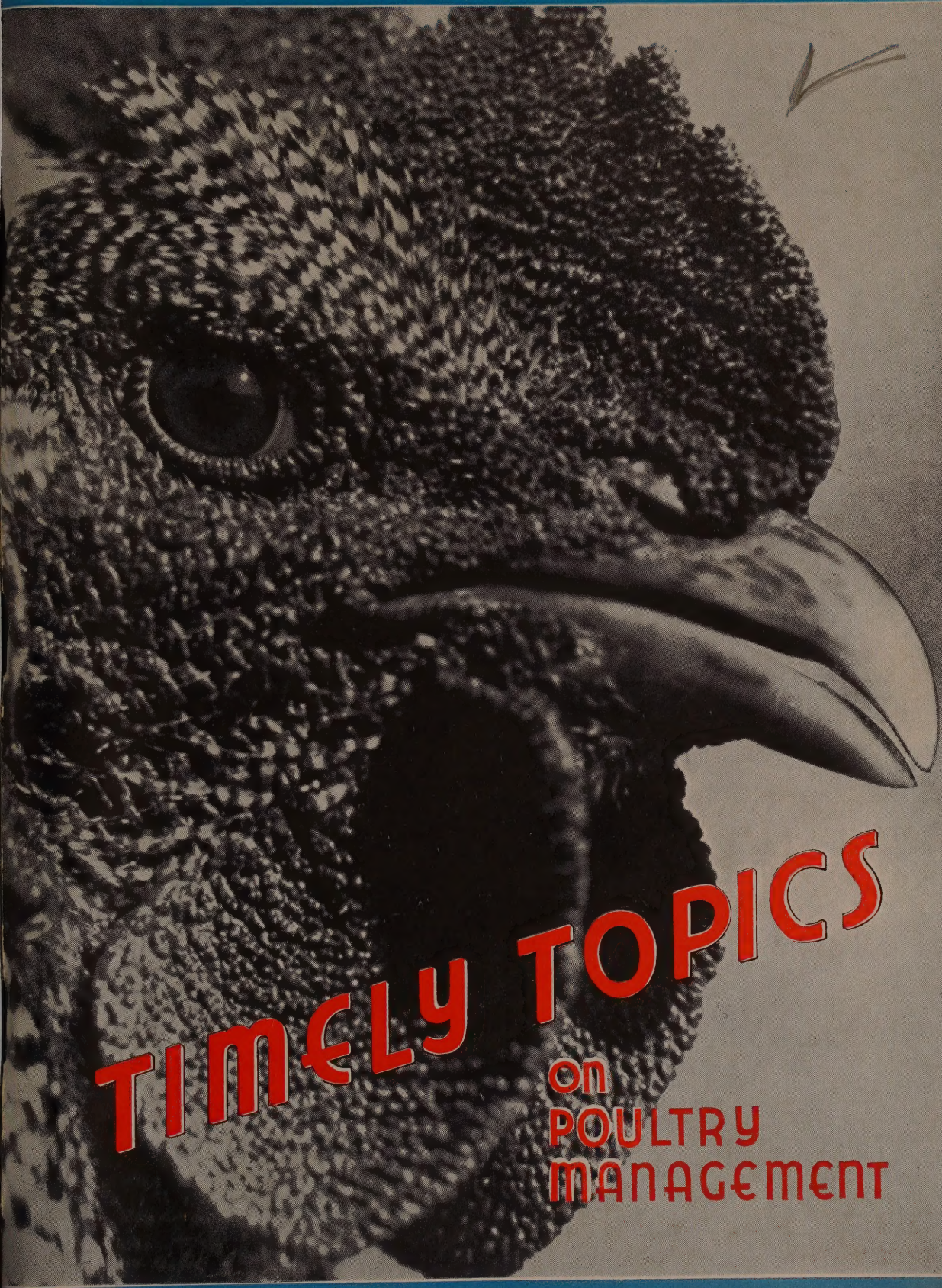


SIXTH EDITION
Edited by . . .



WIRTHMORE POULTRY SERVICE DEPT.



TIMELY TOPICS
ON
POULTRY
MANAGEMENT

“Timely Topics”
Sixth Edition

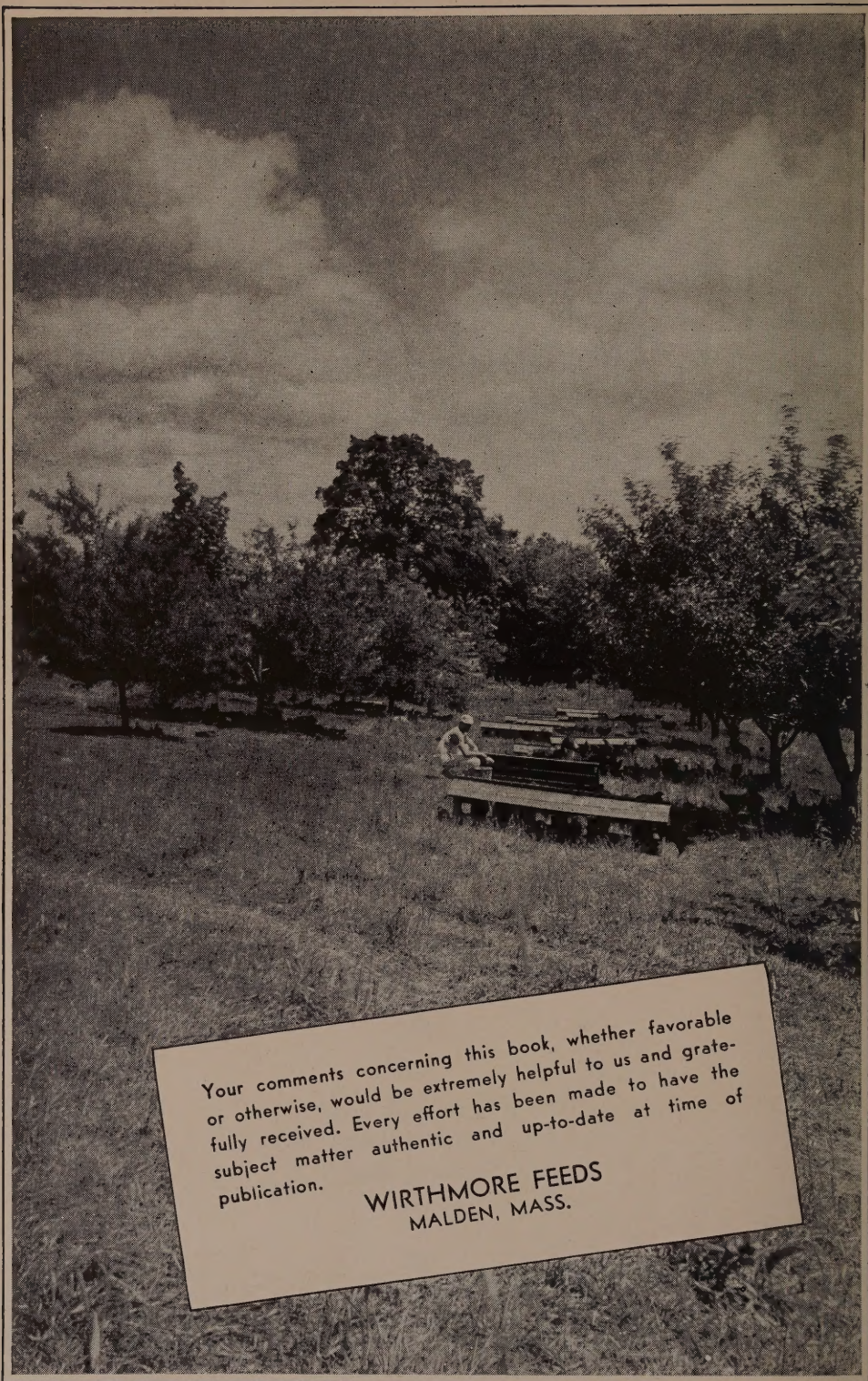
Edited by



Poultry Service Department

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Your comments concerning this book, whether favorable or otherwise, would be extremely helpful to us and gratefully received. Every effort has been made to have the subject matter authentic and up-to-date at time of publication.

WIRTHMORE FEEDS
MALDEN, MASS.

*the answer*_____

to all of the problems of the poultryman has not as yet been published but it is hoped that some of the suggestions in this book may prove helpful to our New England poultrymen friends. Proper application of the principles of management and feeding will help to balance the item of production costs with market returns and leave a margin to make life on the poultry farm richer and happier.

Wirthmore Poultry Service Department

A brief summary of the contents of this book will be found on
pages 182 and 183



When You Buy Your Chicks



Study 'Em from Every Angle!

The BABY CHICK

Management and Feeding

Success in the poultry business depends largely upon the quality of the chicks that are placed in the brooder house. Consequently, much time and thought should be given to their selection, which includes, of course, where to get them. There is no good reason for any poultryman to grow anything but quality stock and by "quality" we mean:

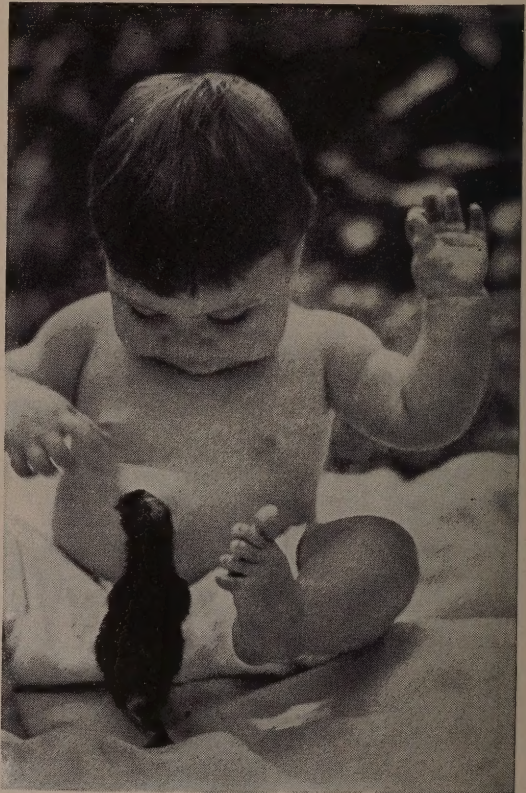
1. Physical vitality and vigor, resulting from sound management, breeding, and feeding of parent stock, and from proper incubation.
2. Freedom from disease.
3. A sound breeding background.

Indications of Vitality in Baby Chicks

At time of delivery, baby chicks should be examined for outward indications of vigor. If a high rate of livability is to be expected, vigorous, alert chicks which show an active interest in life are absolutely necessary.

Condition in Baby Chicks

There should be no evidence of poorly healed navels. Faulty incubation is the usual cause of this trouble. Faulty incubation, likewise, results in small, soft, sticky chicks with pale shriveled shanks and short down.



Ewing Galloway Studios, New York

Overheating in transit is indicated by soft, flat, listless chicks. Severe chilling causes the chicks to scratch the chick pads from the center of the box to the outside edges.

Chick Size and Weight

The weight of good-quality chickens should be not less than eight and one-half pounds net per hundred. Uniformity in size is also to be desired. Chick size is determined by the size of the hatching egg set, by incubation, and by the physical condition of the parent stock.

Freedom From Disease — Pullorum-Clean Stock

It is highly advisable to limit baby-chick purchases to sources which have been tested and found free from pullorum disease.

Individually and collectively the New England States are highly efficient in the control of pullorum disease through their testing programs and stringent administration of regulations connected with these programs. Today the occurrence of the disease in New England-bred stock is rare. Experience with chicks from other sections of the country shows convincingly that this disease is not so well controlled outside of New England.

Barring pullorum disease, such diseases as are common in New England are not, so far at least, definitely known to be transmitted through the egg to the baby chick.



Vim, vigor and vitality!

There is, however, some evidence which bears out the contention that stock may have inherited weakness that lowers its resistance and makes it more susceptible to certain diseases.

What Characteristics to Look For in a Strain

It is the function of the individual breeder to govern certain characteristics within the strain which he is breeding. Elimination of the undesirable and intensification of the desirable characteristics often constitute his life work. It is advisable for the prospective buyer to investigate any strain of birds from which he contemplates buying chicks. If possible, he should visit the breeder or else observe flocks of birds from that breeder on other farms. The following are some of the desired characteristics in any strain that is being considered:

- | | |
|-------------------------------|------------------------------------|
| 1. High egg production. | 5. Livability and vitality. |
| 2. Freedom from broodiness. | 6. Body size. |
| 3. Freedom from winter pause. | 7. Early feathering. |
| 4. Good egg size. | 8. Reasonable uniformity of color. |

The extent to which chicks inherit these and several other characteristics comprises a level above which the growing and mature birds have no chance of rising, even under the most favorable conditions. To a certain extent these factors are all controllable by intelligent breeding work. They all have a distinct bearing on the chances of profit on any poultry farm. Due to the fact that after arrival of chickens at the farm there is no control over these inherited characteristics, it is certainly good insurance to spend both time and effort in investigating sources from which stock is being considered for purchase.

Grade of Chickens to Buy

Many breeders who are engaged in extensive programs of pedigreeing offer several grades of chicks from their flocks. These various grades have a definite place in the programs of prospective buyers. These grades are generally designated as follows:

1. Flock matings.
2. Special matings.
3. Pedigreed matings.

The prices of these chicks will vary with the degree of intensity of the breeding. When buying chicks, the commercial poultryman who wishes to raise pullets for egg-production purposes only, should buy flock-mated stock. But the higher priced grades of chicks have their place with the buyer who is seeking foundation stock or new blood to fit into his breeding program. Where a breeder or hatchery is offering graded chicks without tying these grades up with a definite breeding program, it is generally advisable to buy the best chicks that are offered.

Old-Hen Chicks

Many breeders offer chicks from old-hen matings. There is generally an additional charge for these chicks. Here again, it is advisable to buy these higher priced chicks if they are to be introduced into a breeding program. The background of longevity in the parent stock justifies the extra cost of these chicks.

What Breed to Select

The selection of a breed for replacement stock depends not only on the personal preference of the buyer but on such factors as climatic conditions, and market for eggs and poultry meat. Most New England markets prefer brown eggs. For this reason the general-purpose breeds make up a large percentage of New England's laying flocks. In sections where the market for poultry meat is at all favorable there is an advantage in using general-purpose breeds. These include Rhode Island Reds, Barred Plymouth Rocks, New Hampshires, White Plymouth Rocks and White Wyandottes.

In sections where the New York egg-market influence is felt, the White Leghorn continues to hold a great deal of its popularity.

Sexed and Sex-Linked Crosses

There is a growing demand for all-pullet chicks. This trend is generally among poultrymen who have limited brooding and ranging facilities. In normal years the growing of cockerels for broilers and roasters is a source of income on many farms. This limits the demand for the sexed and sex-linked crosses.

SEX-LINKED CROSSES produce baby chicks in which the males and females show different color markings at hatching time. The most popular of these crosses is that of the Rhode Island Red male and the Barred Plymouth Rock female.

CHICK SEXING by the Japanese method is done to a certain extent in New England at the present time. The sex of the chicks can be determined as soon as they are 12 hours old. A high degree of training and experience is necessary in order to do this work successfully and with any amount of speed. The actual determination is accomplished by examining the rudimentary sex organs just inside the vent. With experience this can be done without injury to the chicken.

Where to Buy Quality Stock

A slogan that New England poultrymen can well use to their own advantage is "Buy at Home." No section of the country excels New England in the production of quality chicks. Many of the outstanding breeders of the country are located in New England, and their work has had a deep influence. In addition, the New England climate is conducive to the production of hardy, vigorous stock.



Whatever way you look at it, the New England chick is the kind to buy!

New England's pullorum-control programs are not equaled in any other part of the country.

Heavy-producing, disease-resistant, hardy stock is close at hand and can be secured without the risks of long shipments, and it is possible to directly contact the sources in many cases. In general it is not necessary to go outside of New England to secure the best chicks available for any particular use and at a price which is decidedly reasonable for the quality of stock offered.

When to Brood

It should be the aim of the poultryman to produce a pullet which will come into the laying house at a time to pay him the most income and to best fit into his laying-house program. Each individual poultryman has his own set

of circumstances. His brooding program must be built around them. Thus, it is impossible here to more than point out the various ranges in brooding dates most generally accepted as advantageous.

THE NORMAL BROODING SEASON, as generally understood, extends through the late winter and spring months. The dates selected within this season for starting the chicks depend upon the circumstances existing on the individual plant.

The commercial poultryman who is forced to start several broods over a considerable length of time and who has brooding equipment which is adapted to this type of program, must necessarily start chicks as early as January or late December. His season may extend into April. It must be remembered that January-hatched chicks will mature from two to four weeks earlier in life than those of the same strain hatched later in the season and invariably will lay smaller sized eggs.

The breeder who has a baby chick sales season which reaches its peak during March and April will be forced to assure himself of his own allotment of chicks earlier in the season or else to extend his brooding activities into May in order to fill his pullet requirements.

If the poultryman's sole objective is to produce pullets for the production of market eggs, we recommend that he restrict his dates for starting chicks to a season extending from early February to the 15th of

April. If necessary, it is possible to brood two lots of chicks within this period in the same brooding quarters. Where only one lot of chicks is to be started, it is generally advisable to select a date sometime during March.

There are several clear-cut reasons, both of physical and economic nature, for selecting the earlier starting dates. Among these are:

1. There is less trouble with disease.
2. Chicks are less likely to come from breeding stock which has become depleted.
3. It is easier to regulate brooder-house temperatures.
4. The pullets will produce more eggs during season of high egg prices.
5. The broilers can be sold on a more favorable market.

"Out-of-Season" Brooding

Brooding during the fall months (from the middle of September to the last of November) has come into the picture more and more during the last few seasons. The utilization both of brooder space and labor, made possible by this "out-of-season" brooding, is an advantage on many plants. The birds brooded at this time come into production in time to replace the normal summer reduction in laying flocks.

"Out-of-season" brooding has a definite place on certain plants where range facilities are limited; also, for the man who retails eggs and poultry meat and who requires a steady output. We recommend that this man start one-quarter of his chicks in September and October; one-quarter in January; and the balance in March or April.

The "out-of-season" birds are necessarily reared in confinement during the greater part of their growing period. By the use of gravel runs and limited yards the birds may be "hardened off," and allowed to run for a time during favorable fall weather. The number of chicks started under these conditions is necessarily smaller than would be the case under normal brooding and rearing conditions. It is advisable to place not more than 150 to 200 chicks in the space recommended for 300 during the regular brooding season unless additional space is available for dividing the flock two or three times during the brooding and rearing seasons.

Brooder Houses

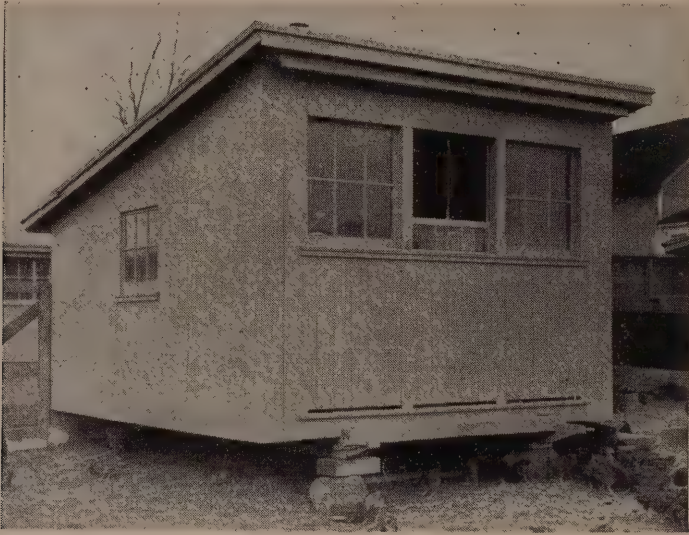
Brooding activities are not limited to any particular type of house. The brooding system selected will be based both upon the preference of the individual and the nature and extent of his business. Any brooding quarters should, however, possess several essentials such as:

1. Freedom from drafts.
2. Ease and economy in heating.
3. Convenience and economy of labor.
4. Sufficient size to accommodate both chickens and equipment.
5. Proper lighting and good ventilation.

There are two types of brooder houses in general use throughout New England. These are the colony and the permanent brooder houses.

The Colony Brooder House

The colony brooder house remains the most popular of these two types. The dimensions of these houses should be at least 10 by 12 feet and



Colony brooder house with slot ventilation.

preferably 12 by 12 or deeper. They accommodate one brood of 250 to 300 chickens and carry a single heating unit. These houses are especially adapted for use by the small operator. He often moves the house to a new location each season and uses it both for brooding and rearing purposes. When this is done, adequate provision should be made for summer ventilation.

Many poultrymen who operate on a large scale are continuing to use the colony system in spite of the added labor. It fits well into a disease-control program, especially where several broods of different ages are brooded at one time.

To lessen labor costs many operators first locate the houses close to their dwellings, then when the ranging season arrives, they haul them, with the flock inside, to the desired spot on the range. Gravel runs should be available during the brooding season as an aid in "hardening off" the chicks.

Frequently the colony house is left permanently on one spot with a permanent gravel run attached.

The Permanent Brooder House

The permanent brooder house is popular with the New England poultryman who is growing relatively large numbers of birds. It is constructed generally along the lines of a well-built laying house with glass windows and facilities for restricted ventilation, and, preferably,

fully insulated. Many of these houses on larger plants have been constructed with two or more stories. The popular dimensions of the pens are 24 by 24 feet down to a minimum of 20 by 20 feet. Either a central heating system or individual stoves may be used, but the use of hot water heating systems is generally popular in the larger buildings. From the standpoint of labor and heating efficiency, the permanent brooder house is ideal for brooding purposes.

Many times, in "off" seasons, these buildings are utilized for laying hens, as a part of the barracks system recommended by several of the New England Extension Services.

A disease problem appears with this type of brooding when a number of broods of different ages are brought along together in adjoining pens. It is desirable to plan brooding operations in such a manner that one large lot of chicks of one age occupies the house at one time and is completely removed before the next brood is brought in.

It is desirable to use gravel runs where possible for "hardening off" purposes.

Brooder-House Equipment

The type and quantity of brooding equipment has a great deal to do with the final outcome of a brooding season. The choice of the various



Interior of pen in a long brooder house showing hot water heat installed. Here the hovers are being used over individual radiators.

articles comprising the equipment depends to a large degree upon individual circumstances, but the following essentials should always be considered:

1. Adequate to accommodate the number of chicks brooded.
2. Sanitary and easily cleaned.
3. Suited to the changing stages and demands of the chicks.
4. Durable.

Effective brooding equipment should be adapted to the individual set-up and should generally include:

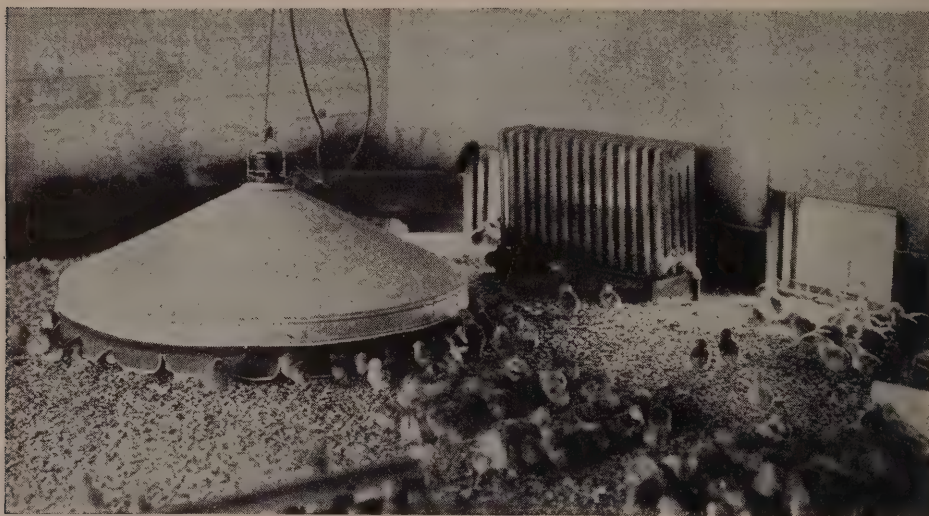
1. Heating system.
2. Feeding equipment.
3. Watering equipment.
4. Brooding guard.
5. Roosts.
6. Wire platforms for feeding and watering equipment.
7. Lights.
8. Gravel runs.
9. Thermometer.

Heating Systems

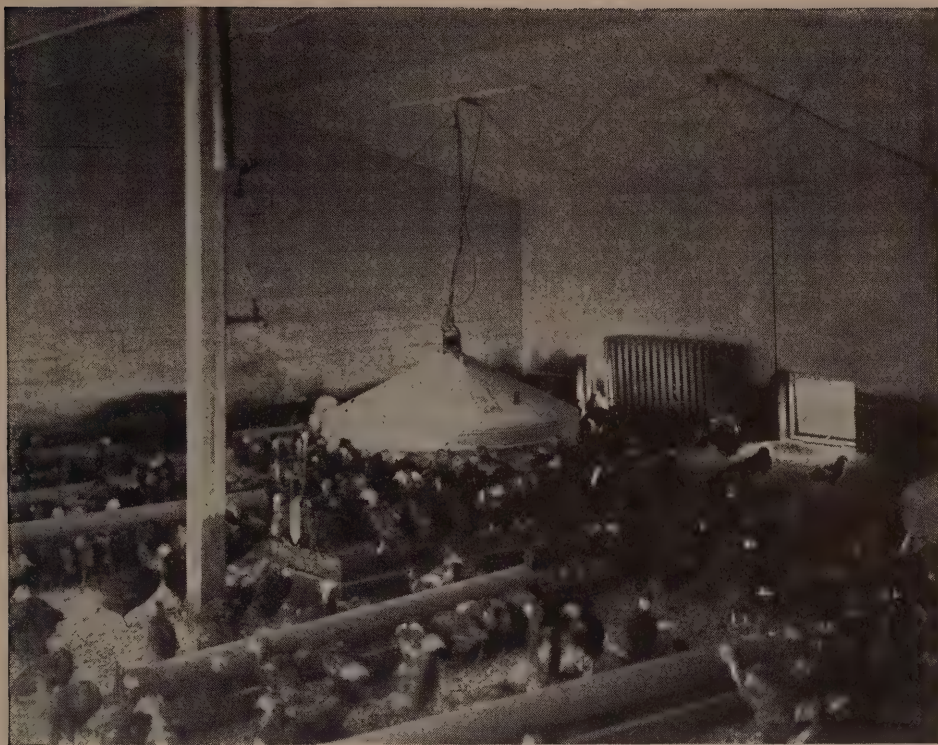
The choice of a type of heating system depends largely on the system of brooding used. Where the long permanent brooder house is used, the central heating unit is the most popular. In case of the colony system of housing, the use of the individual stove of one type or another prevails.

Central Heating Systems

The hot water system is well adapted to the heating of the long permanent brooder house of one or more stories. Its use as a central heating unit allows a great saving of labor and fuel and produces an even heat



Section of a long brooder house with electric brooder and auxiliary hot water heat in use.



Another view of electric brooder and hot water heat in use in a long brooder house.

which is easily controlled. Many of the recent installations have been fitted with individual radiators with hover arrangements for each brooding unit. This gives a more flexible control of temperature adjustable to different ages of chicks in one house. Steam and hot air installations are satisfactory, although fewer in number than hot water. When planning such installations, it is advisable to consult with heating engineers concerning installation and radiation problems.

Individual Heating Units

The individual heating unit continues to be the poultryman's most popular substitute for mother hen.

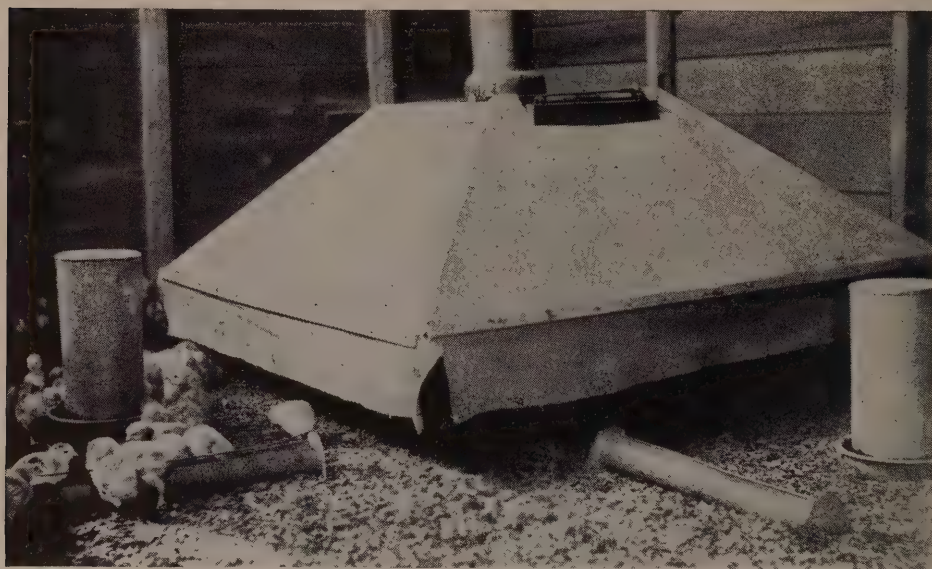
THE COAL STOVE is still the most generally used among the individual units. In late years it has been meeting serious competition from other types of heaters. Due to its established dependability and freedom from fire hazards, it undoubtedly will continue to hold its popularity.

THE OIL BROODER has achieved popularity because of its convenience and labor-saving qualities. Great improvements have been made in oil-burning brooders. The efficiency of several on the market is on a par with that of coal stoves. Due to the volatile nature of the fuel used, there still remains a fire hazard, especially in the hands of the inexperienced operators.

THE ELECTRIC BROODER has come into general use throughout New England. Where power is available and the rates are reasonable, it has been found to be both economical and efficient to operate. When it is used for early brooding, it may be advisable to furnish auxiliary heat due to the fact that the electric brooder does not heat the area surrounding the hover. It has been found particularly adapted to brooding operations in the long permanent brooder houses where auxiliary heat can be furnished by use of a central heating system or by use of either coal or oil burners in alternating units. Its use in late-season brooding has been particularly satisfactory due to the cool room temperatures. A wire platform under the hover helps eliminate dampness. Research work has shown that cold-room brooding conditions such as are present where electric brooders are used are conducive to early feathering and also helpful in the "hardening off" of the chicks.

It is necessary to have feed and water available under, or at the edge of, the hover for the first few days of brooding.

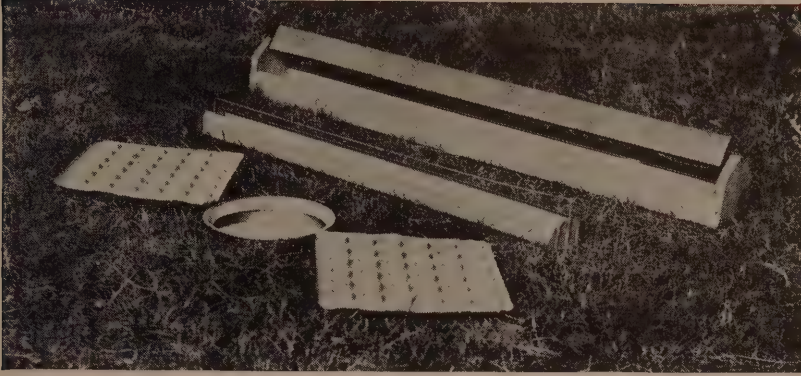
Electric power rates must be low to compete in cost with coal and oil, and the source of current must be free from interruptions lasting more than three to four hours. It is advisable to purchase the better type of insulated hovers equipped with circulation fan.



Wood-burning brooder stove equipped with cloth curtains. Note the tile used as a stove pipe to prevent creosote condensation.

THE WOOD-BURNING BROODER is becoming more popular in sections where the supply of green wood is ample and economical. It is satisfactory in operation and is well adapted to use on many farms. When it is used, special precautions must be taken to prevent the condensation of creosote in the stove pipes.

Feeding Equipment



The feeding utensils in the brooder house must meet the demands of the chicks throughout changing stages of growth. See score card on page 28 for judging feeding and watering equipment prior to its construction or purchase.

The importance of adequate feeding equipment is often overlooked. Many vices may spring from lack of hopper space. Unsatisfactory growth and susceptibility to diseases are direct results. It is recommended that one inch of hopper space per chick be allowed at the beginning. Commencing the third week gradually add more hopper space until, by the end of the fourth week, the amount is doubled.

It is advisable either to use a hopper adjustable to the different stages of growth of the chicken or to use two separate sets of hoppers. The first of these sets should be small, with the feed easily accessible to the smaller chick, and the other larger to meet the demands of the chick after three to four weeks. It should always be borne in mind that the increase in hopper space must keep pace with the growth of the chicken.

Watering Equipment

Water should be available at all times from fountains easily accessible to the chickens. It is advisable to use several small containers, such as quart jars, for the first few days, then substitute one or two centrally located fountains, each three to five gallons in size. Automatic fountains are popular where water pressure is available. The waterer should be so constructed as to be sanitary and easily cleaned.

Wire Platforms for Feeders and Waterers

The use of wire platforms upon which to place the feeders and waterers is a good sanitation practice. They should be constructed in such a manner that both feed and water that is wasted will pass down out of the reach of the chicks through one-inch-mesh, 16-gauge wire. It is also advisable to build the platforms in such a manner as to allow droppings that are voided while the chicks are feeding to be taken care of in the same manner.

Brooder Guard

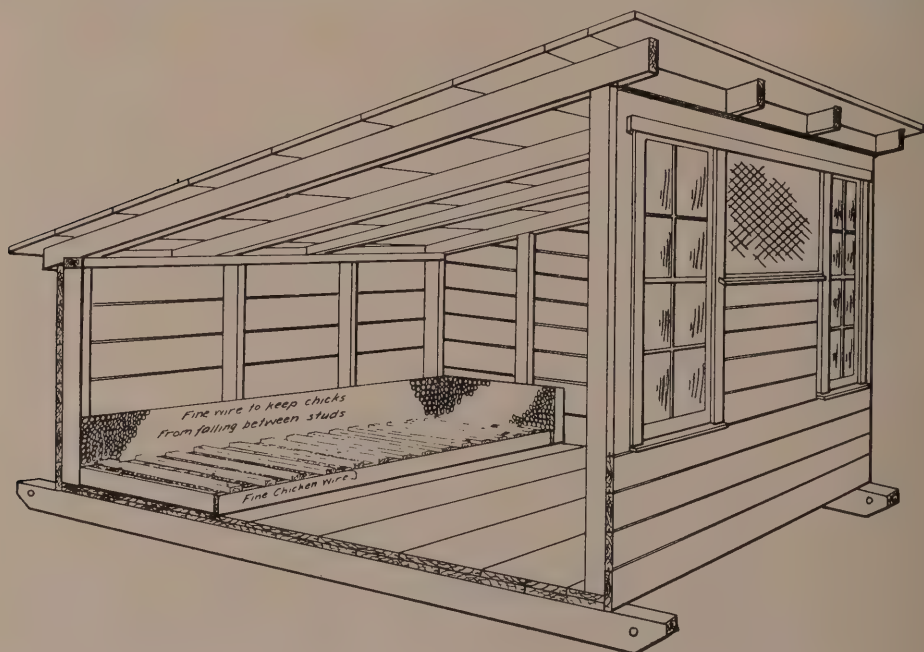
It is recommended that a brooder guard be used to confine the chicks to areas close to the brooder stove until they become accustomed to the surroundings and to the source of heat. It prevents the dangers of chilling due to floor drafts, and keeps the chickens within a safe area. Inch-mesh wire, corrugated cardboard, and hinged boards are used. If guards of solid material are used, there is always danger of overheating, hence they should not be placed too close to the hover. If the house is free from drafts, uncovered wire may be used solely, as it is sufficient to confine the chicks and allows for free ventilation. The guard should be about one foot in height.

Roosts

Since early roosting solves many problems later in the life of the bird and also helps to prevent crowding, it is desirable to have some type of roosting frames available to the chicks at an early age.

Two sets of roosting frames can be used to advantage — the first set to be used for chicks from two and one-half to five weeks of age. These roosting frames are constructed of one-inch material. They rest on the floor where the chicks congregate at night, and encourage early roosting. These frames may be made with roosts six inches apart and about three feet in length. In this size they are easy to move and place wherever desired.

The second set of roosting frames (as shown in illustration below) is suggested for use throughout the remainder of the brooding season. These frames are flat and may be constructed of light material such as three-inch furring, and with dimensions to fit the brooding quarters



in which the frames are to be placed. The roosts can be one-inch by two-inch material and should be placed six inches apart. They should run crosswise of the frame as this encourages roosting over the entire frame. One-inch-mesh chicken wire should be fastened beneath the roosts. The frame should be so constructed as to prevent access of the chicks to the area beneath the roosts. These frames are low enough to be easily accessible to chickens three to four weeks of age. If the chickens are to remain in the brooding quarters throughout the rearing season until maturity, the frames can be raised up from the floor to the required height.

Lights

A seven-and-one-half-watt light under the hover, or the same size light or barn lantern turned low and suspended directly over the hover, will greatly aid in preventing crowding and insuring even distribution of chickens around the stove.

Sand and Gravel Runs

Gravel runs have become standard equipment on many poultry farms and have replaced wire runs to a large extent. They have proved less expensive to construct and generally more satisfactory. The chickens adapt themselves to them rapidly. These gravel runs are constructed by setting up six-inch boards edgewise, surrounding an area at least equal in size to that of the brooding quarters themselves. Fine gravel or coarse sand is then deposited in this enclosure to the depth of four or five inches. If cinders are available at better advantage, they may be satisfactorily substituted.





Gravel run in front of permanent brooder house.

Sanitation Program for the Brooder House

Sanitation plays an important part in a brooding program. The highest quality chicks will not thrive and grow normally under unsanitary conditions. Sanitation should be tied in with other chick management plans, and a definite program laid out.

Cleaning the Brooder House

It is highly advisable to allow ample time for the brooder house to dry out after cleaning, and to set up the brooding equipment before arrival of the chickens. Plans should be made to empty the brooding quarters in order to make this possible. Movable colony houses should first be cleaned and then transferred to the new location.

In cleaning the house it is best to remove all equipment and house fixtures such as roosts, nests, etc., checking at that time for traces of red mites. By scraping and sweeping, remove all loose dirt and dust from floor, walls and ceiling. As a softening agent, dissolve lye in scalding hot water at the rate of one pound to five gallons. Wet the floors and side walls and allow them to soak until the dirt becomes loosened. Then by scraping and scrubbing, loosen all remaining filth which can then be removed from the house through the use of clean water and a broom. Follow this cleaning process with a good liquid disinfectant used at recommended strength. The use of whitewash is desirable both from the standpoint of germicidal value and of appearance. In case there is any evidence of red mites in the building, it is advisable to paint the floor and part of the side walls with creosote or red-mite paint. In some cases this is done as a matter of precaution.

Preparation of Brooder-House Surroundings

Where permanent brooding quarters are used, the immediate surroundings should be cleaned to prevent a carry-over of disease germs from previous brooding of chicks. Filth and manure should be removed from around the house. Approaches and walks should be covered with sand

or gravel. If gravel runs are used, the top layers should be removed and replaced with clean gravel. Feed rooms, or other rooms through which the operator must pass to enter the brooding quarters, should also be cleaned.

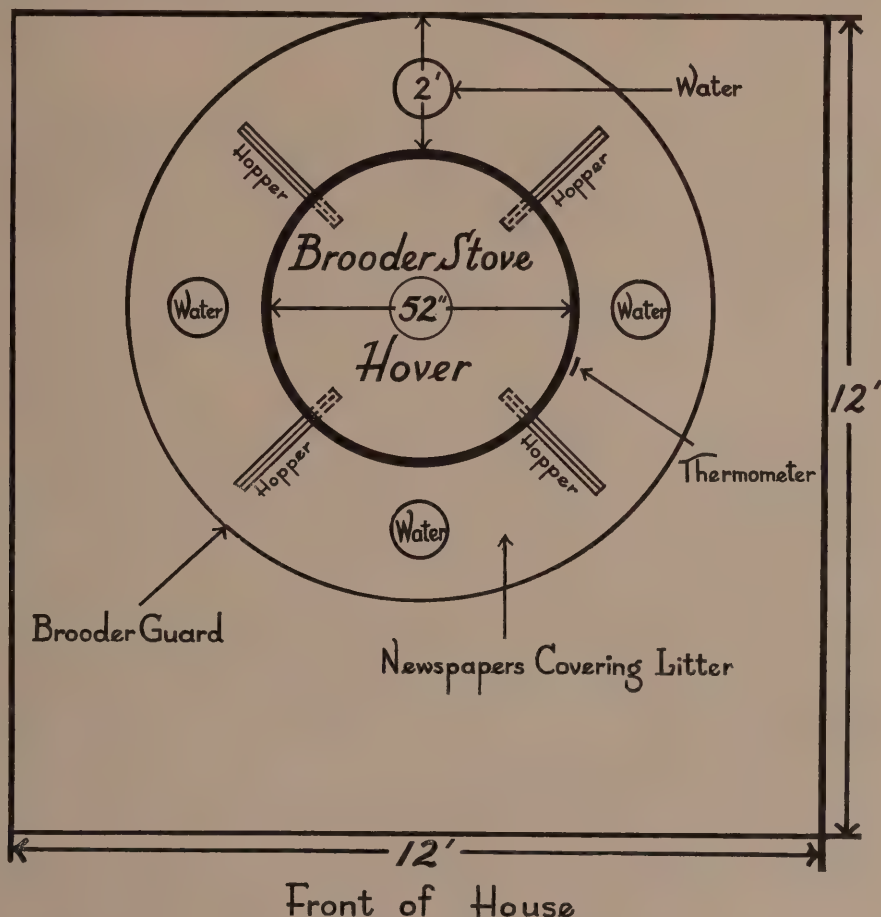
Cleaning the Equipment

All equipment which is placed in the brooder house should be thoroughly cleaned and disinfected.

Preparation of the Brooder House and Equipment

Prior to arrival of chicks, a final check-up of conditions in the brooding quarters and arrangement of brooding equipment in the house should be made. Any possible omissions in the form of minor repairs should be corrected and the necessary attention given to last-minute jobs.

The heating apparatus should be put into operation soon enough to make certain that it is functioning properly and in time to make any needed repairs or necessary replacement of parts. All equipment to be used should be set up in its proper position.



Floor plan of a brooder house showing arrangement of brooding equipment in readiness for arrival of the baby chicks.

THE BROODER STOVE should be in a position well to the rear of the house. In colony houses which are relatively shallow, a position with the edge of the hover two feet from the rear wall is advised. Where the pens are 18 feet or more in depth, a distance of four feet from the hover edge and the rear wall is recommended.

The chick guard should be set up two feet from the edge of the hover.

The brooder light should be suspended under the brooder hover. If impossible to do this, suspend the light over the center of the hover.

Litter should be placed on the floor and covered with two or three layers of newspapers for the first two or three days.

Feed hoppers and waterers should be filled and distributed around the area enclosed by the brooder guard. It is advisable to place the hoppers with one end pointing toward the hover and the other radiating out as the spokes in the hub of a wheel. This position will prevent crowding behind the hoppers.

A thermometer should be suspended from the edge of the hover at a height of two inches above the litter.

Brooder-House Management

Assuming that all the advice previously given has been followed, the fate of the baby chicks and the success of the brooding operations then depend directly on the care given the chicks while in the brooding stage. It is best to have one person responsible for all management, and thus lessen the chances of overlooking necessary details. Below are listed several factors which must be controlled properly to insure satisfactory results:

- | | |
|-----------------------------------|-------------------------|
| 1. Number of chicks in each unit. | 6. Litter Sanitation. |
| 2. Temperature. | 7. Roosting. |
| 3. Humidity. | 8. Separation of sexes. |
| 4. Ventilation. | 9. "Hardening off" |
| 5. Brooder Sanitation. | 10. Feeding. |

The Number of Chicks Brooded in Each Unit

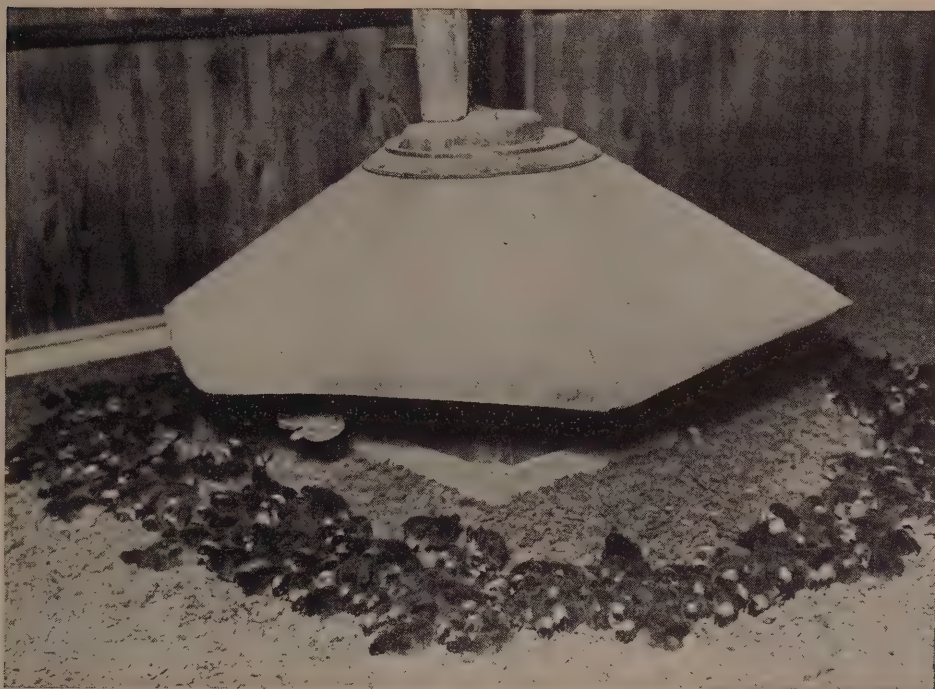
should not exceed 300. For a 10-by-12-foot house the number should be limited to 250. In spite of the fact that there are instances where the poultryman has apparently succeeded with larger numbers, if crowding does not exist there will almost invariably be fewer runts, more uniform growth, better feathering and less mortality.

Brooder-House Temperature

During the first week the temperature at the edge of the hover two inches above the floor should be 90 to 95 degrees. There should be a

gradual reduction of temperature after the first week. A rule often used is to reduce the temperature five degrees weekly for the first four weeks. This will depend somewhat on the weather conditions existing and the season of the year. The comfort and well-being of the brood are the first concern in brooding operations, and, fortunately, the reaction of the baby chickens to existing temperature is generally the best indication on which to base brooding conditions. Many experienced operators disregard thermometers except for the first regulation of the stove, and then base their judgment as to temperature upon the behavior of the chickens. It must be remembered that unhealthy chickens and chicks that have been overheated or chilled will not be normal from the standpoint of the temperature required and will tend to huddle and crave more heat. Extremes in temperature are to be avoided in brooding operations.

Brooding-room temperature should be as low as possible and still maintain the required heat at the edge of the hover. After the first few days, feed and water containers should be placed in the cooler parts of the house. Instinct will lead normal chickens back to the heat of the hover.



Note how these chicks "ring" the brooder stove. Instinctively they have adjusted their position to the existing temperature.

In deep pens it is possible by manipulation of windows and ventilation to keep the front part of the house relatively cool. In small colony houses it is difficult to create these conditions, but adjoining cool rooms

are often used for this purpose. Where electric brooders are used without auxiliary heat, practically any section of the house will be carrying low temperature. Cool room-temperature is conducive to good feathering, the building of vitality and resistance to disease. It helps to guard against such vices as feather picking and cannibalism. Hothouse chicks are never satisfactory.

Humidity

For normal development of the chicks, relatively high humidity is necessary in the brooding quarters for the first two or three weeks. Lack of sufficient moisture in the air results in unthrifty appearance, shriveled shanks, and poor feathering. It is common practice to place containers of water on the stove and under the hover. Another satisfactory method of providing humidity under the hover is through the use of a pail of water and a burlap sack. The open end of the sack is draped over the edge of the pail while the other end rests in the water. After chicks reach three weeks of age, the problem of humidity is normally taken care of by larger water consumption and by the resulting dampness from the droppings.

Ventilation

Plenty of fresh air in the brooder house is essential for normal development. Intakes should be provided to introduce fresh air without creating drafts and to remove the foul air and any brooder-stove fumes.

Indirect ventilating systems are becoming popular. They are built with indirect air intakes under the windows and with slots located at the highest point in the front of the house to remove foul air.

Brooder Sanitation

Let us assume that upon arrival the baby chick is free from disease, high in vitality, and has an average amount of disease resistance. Let us assume, too, that the building and equipment are thoroughly clean. From this point on, the responsibility for maintaining the health and well-being of the chick is shifted directly to the shoulders of the brooder operator. For one thing, contact with adult stock is to be avoided. It is ideal to assign the brooding duties to one person who is not called upon to approach the laying house. If this is not possible, the operator should either change shoes, or put on rubbers which are used solely in the brooding quarters. Quarantine measures should be upheld. This means excluding visitors from the brooding pens, and also keeping out crates, cleaning tools, used sacks, or other articles which may have been in contact with birds in other flocks.

Sanitary feeding and watering equipment is essential. Waste-proof feeders and waterers play a large part in the program. Frequent clean-

ing and an occasional scalding of watering equipment during the brooding period is advisable. The early use of wire platforms both for waterers and feeders is a fundamental part of a sanitation program.

Litter Sanitation

There is a wide choice of satisfactory litters available. Among the more popular are fine gravel or coarse sand, peat moss, shavings, and sugar cane. Availability and cost are factors to be considered in making a choice. If cut straw is used, it should be examined carefully for evidence of mold. In some sections it is common practice to use sand or gravel as a base for other litters.

Deep litter has been recommended by many authorities and is quite popular with poultrymen. It may remain in the house for the entire brooding period. A normal floor covering of two to three inches may be used during the first two to three weeks, and additional litter added to the depth of five to six inches. The litter should be raked and stirred daily. For successful results the litter must remain dry and should be removed if it becomes foul and damp. Caked and damp portions should be removed from points where the chicks congregate at night and also from around the water fountains or windows.

Many poultrymen still prefer the periodic cleaning program. It lessens the danger present in the "deep-litter" system when wet, caked, or otherwise contaminated litter is not promptly removed.

Roosting

Roosting habits should be formed early in the life of the chicken. If chicks are allowed to huddle on the floor, mortality and uneven growth will result. There will also be difficulty throughout the life of the birds to get them to roost satisfactorily.

Roosting may be encouraged as early as two and one-half to three weeks by placing low roosting frames on the floor where the chickens congregate at night. Many poultrymen use these frames and gradually block them off the floor as the chickens become accustomed to them and grow in size.

When the chickens are five to six weeks of age, a roosting frame should be constructed in a position at the rear or the sides of the pen to furnish roosting facilities for the flock during the remainder of the brooding season.

If the chickens fail to use these roosts at night, they should be driven onto them after dark with the use of a flash light. If necessary, they may be confined to the roosts by a low fence for a short period during the first few nights.

Separation of Sexes

As soon as they can be identified, cockerels should be separated from

pullets. Undesirable pullets may be removed at the same time. This practice relieves the crowded condition of the brooder house and makes it possible to better handle the male birds for the production of meat and for their prospective use as breeding males.

"Hardening Off" the Pullets

It is the tendency of most poultrymen to coddle their chicks and to keep them too warm. Lowering of brooder-house temperature and the use of cool rooms and gravel runs out-of-doors are essential in "hardening off" the pullets. Feeding and watering equipment should gradually be removed from the source of heat, and the chickens forced to go into cool areas. If the chicks are properly "hardened off" early in the brooding period, they can be more safely removed from the brooding quarters to range shelters at from 6 to 12 weeks of age, depending upon the season of the year. In any case, the use of lower temperature and



Gravel runs used in "hardening off" chicks under rigorous winter conditions found "down in Maine."

gradual hardening of the chicks will result in hardier and more rugged pullets with ability to resist disease and to stand up later on during the growing and laying periods.

Feeding Chickens During the Brooding Period

WHEN TO FEED. Have feed and water available for the chicks when they are placed under the hover. In cases where they are received from a hatchery or breeder, this should be done immediately upon arrival. Where the chicks are to be removed from an incubator on the plant where they are to be brooded, they should be left in the hatching trays or in baby-chick boxes for a period of 12 hours after the hatch is completed.

Right from the start feed should be available in small, waste-proof hoppers. For the first two or three days feed should also be placed on newspapers, paper plates, cup flats, shoe-box covers, or other similar surfaces. It is recommended that the litter be covered with several layers of newspaper to keep the baby chicks from eating litter. By taking these papers up a layer at a time, they furnish a satisfactory feeding surface for the first two or three days. Lukewarm water should be available in several suitable waterers placed within easy reach. The third day supply mica or granite grit in separate containers. This type of grit will not unbalance the calcium and phosphorus content of Wirthmore chick rations, which is properly established by the manufacturer. Proper feed hoppers and waterers, their location and number, are important factors in raising uniform, satisfactory chicks. The amount of feeding space recommended for baby chicks is one inch per chick at first, gradually increasing until at the end of the fourth week the feeding space is doubled. Always provide enough space in order that all the chicks can eat at one time.

Fresh, young green feed may be fed after the first week if available. Feed only small quantities at start, then increase to what the chicks will clean up in a few minutes. Green feed is not necessary, however, with either Wirthmore Baby Chick Starter or Wirthmore Complete Chick Starter and Broiler Ration.

We recommend that the chickens be allowed to clean out the hoppers at least once each day. Let this occur in the mid-afternoon, leaving the hoppers empty for approximately one hour. It is believed that there are two distinct advantages of this "clean-up" method—that of maintaining a keenness of appetite and of enabling the poultryman to better measure daily food consumption. There are indications that this method usually builds healthier chicks. Nevertheless, it may be conducive to feather picking and cannibalism unless strict attention is paid to all management details. When fresh feed is added, it is recommended that any mash remaining in the hopper from previous feedings be pushed to one end before the new is added.

WHEN USING WIRTHMORE COMPLETE CHICK STARTER AND BROILER RATION, feed until the chickens are 9 to 12 weeks of age, then change to Wirthmore Complete Growing Ration, or, if you then wish to follow the scratch-and-mash system, change to Wirthmore Growing Mash and Wirthmore Scratch Feed.

WHEN USING WIRTHMORE BABY CHICK STARTER, gradually change at the end of the *sixth* week to Wirthmore Growing Mash and Wirthmore Intermediate Scratch Feed, or, if you then wish to start feeding by the complete-ration system, change to Wirthmore Complete Chick Starter and Broiler Ration and feed as directed above.

Cockerels to be raised for broilers should be changed at the end of the sixth week to Wirthmore Complete Chick Starter and Broiler Ration and continued on this ration until marketed. For full directions on feeding cockerels grown for meat purposes turn to page 142.

HOW TO FEED SCRATCH GRAINS if used with Wirthmore Baby Chick Starter. No scratch grains need be fed with Wirthmore Baby Chick Starter before the end of the sixth week. For those poultrymen who prefer to give their small chicks some hard grains along with Wirthmore Baby Chick Starter, we advise either of the two following methods of feeding Wirthmore Baby Chick Scratch:

First Method — Hand feed the chick scratch grain, scattering it in the litter in very small quantities three or four times daily during the first two weeks at the total daily rate of a half pint per 100 chicks; for the third and fourth weeks, one pint daily per 100 chicks.

Second Method — Feed in hoppers late in the afternoon whatever quantity of chick scratch the chicks will clean up that night. Follow this procedure until the end of the fourth week.

Start feeding Wirthmore Intermediate Scratch at the end of the fourth week in place of the Wirthmore Baby Chick Scratch, using either of the two following methods:

First Method — Hand feed, scattering Wirthmore Intermediate Scratch in the litter. Feed one quart per 100 chicks during the day, and two hours before dark give the chicks all they will clean up.

Second Method — Hopper feed Wirthmore Intermediate Scratch, keeping a supply before the chicks constantly.

The above directions for feeding scratch grains apply only to the end of the sixth week.

Score Card for Judging Feeding and Watering Equipment

Prior to purchase or construction of feeding and watering equipment, a little time spent in rating its relative efficiency and practical value is well worth while. The score card should prove useful for this purpose.

Ease with which chickens may eat or drink.....	20	.....
Construction to prevent waste or spilling.....	10	.....
Construction to preserve sanitation.....	10	.....
Range in age of stock it will serve.....	10	.....
Ease with which it may be filled.....	10	.....
Capacity for feed or water.....	10	.....
Simplicity of construction.....	10	.....
Durability of construction.....	10	.....
COST—considering life and number of birds it will serve....	10	.....
SCORE		.....

Courtesy of Connecticut State College Extension, by Roy E. Jones, Extension Poultryman.

The GROWING STOCK

Management and Feeding

The kind of a pullet that is housed at maturity is governed in no small degree by the care and feed she receives during her growing period. Most New England poultrymen select their chicks wisely and take reasonably good care of them during the brooding period. It is equally important to continue this same care in management and feeding during the balance of the time before the pullets become laying hens.

The success or failure of the methods employed during this period is quite accurately reflected during the mature life of the pullets, partly by the production of eggs but more so by the mortality records of the flock.

The recommendations that follow are the result of years of experience on our own Demonstration Farm in Lynnfield Center, Massachusetts; studying the recommendations of the experimental stations and extension services of the various state agricultural colleges; and of keen observation by our field men over a period of years on hundreds of poultry farms throughout New England.

At the Wirthmore Demonstration Farm three systems are used in



A Maine Poultry Range.



Two Groups of Pullets on Range
at Wirthmore Demonstration Farm.

growing pullets. These are very similar to those used on many commercial farms throughout New England.

In one system the chicks are started in a permanent hot-water-heated brooder house. When six weeks of age the pullets are transferred to colony brooder houses where they are "hardened off" by using gravel runs in front of each house. These pullets stay here from two to six weeks, depending on the season of the year, before they are taken to range shelters.

A second method of using the permanent brooder house occurs later in the spring when the pullets are transferred directly to range shelters at six weeks of age.

In the third system chicks are brooded in individual colony brooder houses with gravel runs and transferred to the range at the earliest age appropriate to the season.

A rotating range system makes it possible to have clean land each year.

Types of Ranges

Clean or Rotated Range

The ideal range system is the two-year or three-year rotation, which is possible only where plenty of land is available. In poultry terminology

"clean range" is land on which poultry has not ranged for at least one year; where no poultry droppings have been used as top-dressing; and where no contamination from drainage is allowed.

Worms and coccidiosis are much easier to control when a rotation system is used, especially if the land is not easy to keep well sodded and if the area is somewhat restricted.

Light, well-drained soil with sufficient loam to grow crops well is the best type for a range. Heavy soil is satisfactory only if it is well drained. A level piece of heavy soil that is not well drained or a heavily wooded area does not make a desirable range.

A wooded hillside or sandy brush land may be used provided the



An excellent range that is well drained and well sodded. It can be used several years without a rest if not overstocked.

underbrush is thinned to allow some sun to hit the ground part of the day.

Sandy districts make it easier to keep out disease but have the disadvantage of being hard to keep well sodded.

The well-sodded range supplies considerable green feed for the birds, thus reducing the feed cost to some extent. If the range is not overstocked, it apparently is possible to use a good sod range for more than one year before giving it a rest.

Plowing, fitting, and reseeding of range is unpopular with commercial poultrymen. This is usually due to lack of equipment. It is not true of farmers who need the equipment for general farming work. It does not seem necessary to crop land during the interval when it is not in use. Spots can be reseeded without plowing by "raking in." Such bare spots, as well as old sods showing moss and a thin stand, may benefit from the application of lime at the rate of about one ton per acre.

Pasture turf makes an ideal chicken range. It differs from newly seeded mowing sod in that it is stronger rooted, thicker, and made up of more permanent grasses. It can be developed within a rather short time by using a mixture of: Kentucky blue grass, 40%; rye grass, 30%; redtop, 10%; white clover, 10%; alsike clover, 10%. This mixture contains grasses that grow quickly and will make pasture within a short time, but it also contains permanent grasses.

Late August or early September is a good time to reseed the range. If plowing is necessary, an early application of poultry manure should be plowed under. This is also a good time to apply commercial fertilizers. When pullets are using the range in the fall, early April is the next choice for plowing or reseeding.

In addition to the use of poultry droppings, pasture growth can be stimulated by applications of a four-eight-eight commercial fertilizer at the rate of 400 pounds to the acre. Grass should not be allowed to go to seed, but must be kept growing by mowing before it reaches maturity, or by pasturing. Pastures are kept in better condition by evenly distributing the shelter houses.

Cut grass that is six inches tall. Such grass is unpalatable, lacks food value, and tends to restrict ranging.

Moving hoppers frequently helps to prevent bare areas and holes in the turf.

There is some saving in feed cost by having good ranges with adequate green feed for the flock. Moreover, it is certain that such ranges are conducive to general good health in the growing flock.

Permanent Range

In all sections of New England there are several excellent examples of permanent ranges where the same land is used year after year with great success. A majority of them fall into one of two classes:

1. Land that is well sodded, well drained and not overstocked during the summer. See illustration on page 31.
2. A sandy piece of ground that is not kept in grass, but is usually brush land and not heavily wooded.

In both cases there is usually, or at least there should be, plenty of land available; the number of pullets per acre is small; the range feed hoppers are moved often; and a permanent automatic watering system is installed.

With proper precautions as to sanitation near the houses or shelters, this type of range should increase in common usage. Cut all grass when six inches tall.

Cultivated Range

Where land area is very limited or where a permanent sod is difficult to establish, the cultivated range is suggested. It may be handled in one of two ways:

1. Spade or plow in late fall or early spring and harrow each week during the growing season or often enough to keep droppings buried.
2. Divide the land into two yards and grow green feed on one while the other is used for a range. Any green feed such as oats, dwarf Essex rape, Swiss chard, clover, alfalfa, rye, etc. may be used. Winter rye may be sown in the fall and used the following spring. When six inches tall, it should be clipped or mowed.

In either system the range hoppers must be moved often, and wire platforms placed under all waterers.

Part-Season Range

A common practice where land is scarce is to brood on one piece of ground and when pullets are 10 to 12 weeks old, move them on to another piece of ground and place them in a house or range shelter. When this is done, any tall grass should be cut before the pullets are placed on the new ground.

"Back-Yard" Range

Even where very little land is available, thousands of good pullets are grown every year by "back-yard" poultrymen.

In such cases most of these poultrymen succeed by using a miniature rotation system (see lower illustration on following page); by using a cultivated range, as is described above; or by using a part-season range, as just described. When rotated yards are used, they should be spaded or harrowed after the birds are moved, and oats, rye, or rape, etc. sowed in late August or early September, or early the next spring in case the yards are used all summer and fall. Greenstuff that is over six inches tall should be clipped before pullets are turned in as it is unpalatable to the birds and tends to prevent ranging.

Regardless of which type of range is adopted, the feed hoppers should be moved at least once or twice a week, and a wire stand should be placed under each waterer.

It is hard to estimate the number of pullets that can be grown on any given area by following the above suggestions. The number will vary according to the type of soil and the drainage of land. Overstocking is indicated by a heavy accumulation of filth. The contamination bound to exist on these small yards adjacent to buildings can be improved by coating the area with fine gravel or coarse sand, renewing as conditions demand.

Size of Range

The type of range or the system of growing pullets should be gov-



The pictures above and others throughout this book serve to show how varied are the conditions under which poultry is kept here in New England. The top picture shows the home of a "back-yard" poultryman. It is located on a busy thoroughfare in one of New England's largest industrial cities. The second picture indicates some of the reasons why this poultry plant has been successfully operated for the last five years on an area less than one-half an acre in size.

The capacity of the laying house is approximately 500 birds. Each year this poultryman successfully broods and rears his replacement stock. Alternating yards help to maintain good sanitary conditions. Each year about one-half of the land is used for a home garden and to furnish succulent green feed for the growing stock.

This poultryman is employed daily in a near-by mill and yet, with the able assistance of his wife, carries on this successful and profitable "back-yard" enterprise. The Wirthmore organization enjoys the patronage of literally thousands of such poultrymen here in New England.

erned by the quantity or size of available range. If the permanent range or the three-year rotation is selected, not more than 250 to 300 pullets should be ranged per acre. More than that number increases danger of disease and the likelihood of finding more poor birds at maturity.

If this quantity of land is not available, some other system of ranging should be selected, or the poultryman should investigate the possibilities of growing more "out-of-season" or fall-hatched chicks and raising a smaller number during the regular growing season.

Shade

In hot weather shade on the range pays dividends in better pullets. Natural shade is best, provided it is not dense. It should be supplied in such a way that the sun reaches all of the ground sometime during the day. Trees and bushes should be thinned and pruned to make this possible.

If no natural shade such as supplied by trees is available, artificial shade must be supplied. Corn alone or mixed with sunflowers makes



With Good Sod, Natural Shade, and Lots of Feed Hoppers, No Wonder the Pullets Grown on This Range Develop into Profitable Layers.

excellent shade. Allow it to become at least 18 inches tall before the birds use it and cultivate it frequently to bury the droppings that accumulate during the hot days. Plant it in strips five to ten rows wide the entire length of the range, with rows five to six feet apart. Summer shelters or colony houses should not be the only source of shade. They are not as cool as is natural shade, and the ground near the house or shelters is likely to become contaminated.

An ideal range shade is a strip of woodland beside the open field where the birds range.

Housing During Growing Period

Range Shelters

One of the most valuable assets in growing good pullets is the range shelter. It is economical, easy to move, and makes ideal roosting quarters for growing pullets.



When only limited range area is available, grouping all of the shelters close together tends to prevent the pullets from crowding into one or two shelters and leaving the others more or less unoccupied. When this practice is followed, it is imperative that the feed hoppers be continually moved to new locations farther and farther away from the shelters.

There are two sizes that are very popular in New England. The most common is nine by ten feet with a removable base covered with one-and-one-half-inch-mesh, 16-gauge wire. The roof may be covered with galvanized iron, insulating board, or roofing paper. If roofing paper is used, it may be laid over one-inch-mesh wire. Occasionally we find such shelters made with a roof of boards and roofing paper, with boards and shingles, or with lapped boards. The capacity of these range shelters is 100 to 125 pullets.

A newer range shelter that is rapidly becoming popular is one smaller in size, either six by eight feet, or eight feet square. It is much more economical to build and is easier to move. The capacity is not over 100 pullets. These smaller units are desirable.

Both of these shelters are described in detail in a new poultry equipment folder issued by the Wirthmore Poultry Service Department and available through your Wirthmore dealer. See page 181.

Before early-hatched pullets are put into range shelters, they should go without heat for from one to three weeks depending upon the

season. In order to protect the young birds from cold nights early in the season, the sides and ends of the shelters should be covered with bags, building paper, roofing paper, sisalcraft paper, galvanized iron, etc. This covering should be removed just as quickly as weather permits. Usually it need not be left on for more than two weeks.



A Light, Economical and Efficient Range Shelter. Size 8' x 8'. Capacity 75 to 100 Pullets to Maturity. Building Plans are Available Free of Charge, see page 181.

We do not recommend putting early-hatched pullets into range shelters before the birds are eight weeks old or are fully feathered. Later hatched chicks may be put out when as young as five or six weeks of age.

For the first week or two be sure that the feed hoppers and waterers are nearby. After the first week, in order to encourage ranging and avoid contamination, gradually move the feed hoppers and waterers farther and farther away.

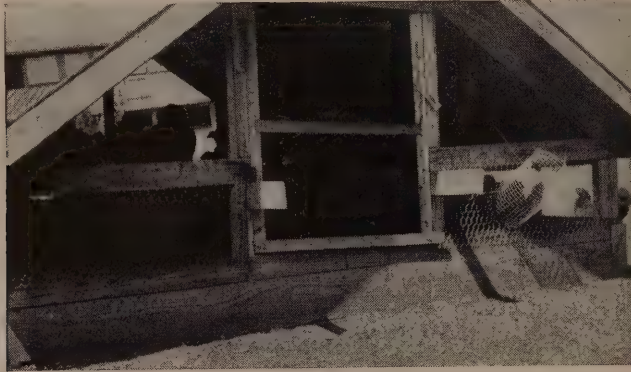
Droppings in range shelters should be removed at least twice during



Note the Bags Used on This Shelter to Protect the Young Birds from Cold Nights Early in the Season.

the season. A convenient and sanitary way to keep the ground clean is to have strips of waterproof paper, which overlap at the edges, placed under the range shelter. The droppings are caught on these strips and are much easier to remove from the range.

Six inches of roosting space per pullet should be provided in each shelter.

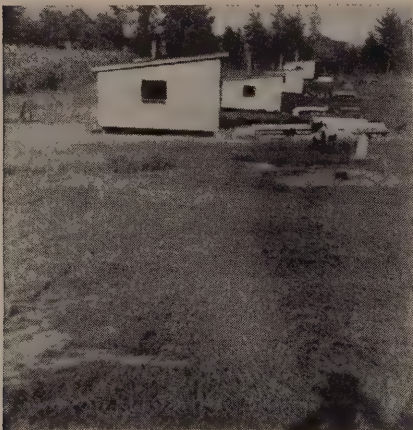


A practical and effective method of releasing pullets early in the morning. Animals such as skunks and foxes are unable to enter through the funnel, yet the birds can easily get out. It can be made of the same kind of wire as is used in constructing the shelter. Inside end of funnel rests on roosts or floor. Funnel is about 8" in diameter and 24" to 30" long. Guy wires hold the outer end of funnel comparatively rigid.

If pullets are released early in the morning, a great deal of trouble such as feather pulling and cannibalism will be avoided. An automatic release, as pictured, will help to release the birds.

Colony Houses

In several sections of New England the colony brooder house is used as the permanent home of the pullet from day-old to maturity. Usually these houses are 10 by 12 feet or larger. Three hundred chicks are started at day-old, and the cockerels removed as soon as they can be identified.



Sometimes colony houses are moved to the new section of the range before the start of the season but usually they are grouped near the dwelling until the brooding season is over and then moved to the new location with the pullets shut inside. From 100 to 150 pullets per house are grown to maturity, the number

being determined by the size of the house.

As with the range shelter, the feed hoppers should be moved away from the house a few feet each week. Late in the growing period it is not uncommon to find feed hoppers located at a distance of several hundred feet from the shelter house. This tends to spread the droppings over a larger area and reduces danger of contamination.

Colony houses may or may not be moved during the range season, depending upon soil conditions. When the houses are moved, it should be done every two to four weeks, depending on sanitation conditions. If the houses are not moved, it is a good plan to rake or sweep around the houses with a steel or bamboo lawn broom each week throughout the growing period. As an added precaution for maintaining cleanliness in this area, it is advisable to spread a load of fine gravel or coarse sand.

A close watch should be maintained during the summer for the appearance of mites. If they are seen or even suspected, all roosts, nests, and cracks in the walls and floor should be thoroughly painted with a tar product such as carbolineum, creosote or similar product, or with a mixture of crank-case oil and kerosene. Do this early in the morning and allow to dry all day, first shutting the birds outside. After the buildings have had two or more applications of this material, one application each year two weeks before the houses are to be used will usually give protection against red mites for that season.

Good ventilation is very important. Openings in the back of the house as well as in the sides and front are advisable.

A sanitation program should be selected and followed to the letter during the entire growing period. One system calls for thin litter replaced periodically when dirty or wet. A better system, and one that is gaining favor rapidly, is to add litter until it is from four to six inches deep and rake it over or stir it once or twice a week. Of course, the droppings under the roosts should be removed when necessary, as well as any wet litter near windows after storms or showers.

Roosting space of six inches per bird is provided. It is very important that growing pullets be made to roost early in life.

Hoppers

Hopper space should be provided so that all of the birds can eat at one time. In other words, as the birds grow, additional hoppers must be supplied. The following is sufficient hopper space for 100 pullets fed either the complete-ration system or the scratch-and-mash system:

Three 4-foot hoppers at eight weeks of age.

Four 4-foot hoppers at twelve weeks of age.

After the pullets reach 16 weeks of age, use same amount of hopper space as recommended for mature birds—two eight-foot hoppers or

three six-foot hoppers per 100 pullets. These hoppers should be low enough to permit the birds to eat from them while standing on the ground. The capacity of these hoppers does not have to be greater than needed for a day's supply. Detailed plans of Wirthmore range hoppers are available free of cost. See page 181. Also see score card on page 28.

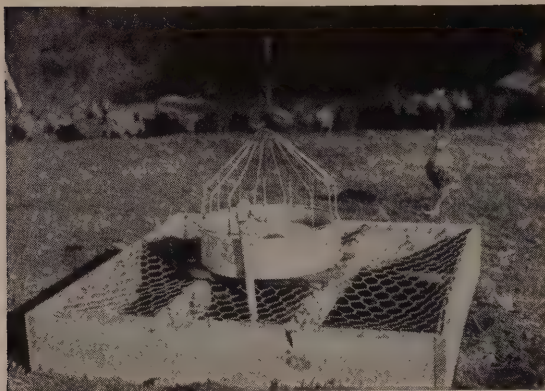
Watering

A steady supply of water is essential.

It goes without saying that carrying water by hand involves a great deal of work. Where water pressure is available, a pipe line may be laid in a plowed furrow and covered for protection and to keep the water cool.

An automatic float is an important part of this system to maintain a steady supply of water.

A wire-covered rack or platform should be placed under each pan



A Labor-Saving and Sanitary Waterer.
Some Shade Would Make it Even Better.

with a dry well to catch any overflow or waste. This helps materially in maintaining a sanitary condition. Either natural or artificial shade over the water pans keeps the water cooler and provides more comfortable conditions for the pullets while drinking. If it is not desired to pipe the range, a barrel with a float attached is a labor-saver. In order to keep the water as cool as possible,

the top of the barrel should be kept covered.

Where individual pans are used, they should be shaded in some way.

Culling

Throughout the growing season no definite program of culling is recommended except to remove any outstanding culls or inferior birds as soon as they appear.

Separation of Males

On commercial egg plants we recommend that no male birds be allowed to run on the same range with the growing pullets. If not previously done, the cockerels should be separated from the pullets at the time the birds are put on range. Any that later prove to be cockerels should be removed as soon as they are detected.

Nests

Nests should be made available as the pullets approach maturity. Orange crates, egg cases, or barrels with holes cut in the sides are satisfactory for pullets in range shelters, although the battery nests, as pic-



A Practical Battery Nest.

tured, are best as they are darker and yet well ventilated. In order that the pullets when housed will find their new nests most easily, those used on the range should be raised to standard height. Otherwise, birds are inclined to persist in floor laying.



An Efficient and Easily Constructed Nesting Arrangement.

Tattooing

We heartily endorse the tattooing program of the Northeastern Poultry Producers Council and the state poultry associations. It is by far the most effective means devised to date for eliminating thieving which has caused such heavy losses in the past.

It is our observation that tattooing birds is not harmful for either laying purposes or for meat production. The job is very simple to perform and may be done any time after the birds are four to six weeks old. A common practice is to combine this operation with vaccination for pox, etc. and thus eliminate an extra handling of the birds.

For information consult the secretary of your county or state poultry association; your state extension service; your county agricultural agent; or a member of the Wirthmore Poultry Service Department.

Vaccination

Vaccinating to prevent a natural outbreak of fowl pox is a regular chore on a majority of the poultry farms in southern New England. It may be done at any time after the birds reach six weeks of age, but the ideal time is when the birds are from 12 to 16 weeks old. In northern New England where fowl pox rarely occurs, vaccination is not recommended.

Early-hatched pullets put on range *before* May 1 should be vaccinated two weeks before they are put on range or else at least two weeks afterwards. In other words, trouble may be encountered if the job is done just before or immediately after putting pullets on range early in the season. It would be safer to vaccinate such birds later in the season, but at least a month before production starts.

It is now common practice to vaccinate *late-hatched* pullets at the time they are put on range. This saves one handling.

Confinement Rearing of Pullets on Floor

Where clean land is not available, where the land is not suitable for ranging pullets, where "out-of-season" pullets are being grown, or when for any other reason it is not feasible to range pullets, it is entirely possible with present knowledge of sanitation, housing, and nutrition to grow excellent replacement pullets entirely in confinement, either in batteries or on the floor.

Inasmuch as the management of caged birds is described in another part of this book, this section deals only with floor rearing.

If pullets are grown in confinement during warm weather, care must be taken to keep down mites and lice.

Ample room is necessary. Allow two to three square feet per pullet up

to three months of age. These dimensions are for *inside* the house. In addition, we advise a gravel run, or if that is not possible, a wire porch in order that birds may get into the open air during the cooler parts of summer days and during the warmer winter days.

Build the gravel runs at least as large as the inside dimensions of the house. Set up four-inch or six-inch boards edgewise around the outside of the run. Fill in with one or two inches of coarse gravel or coarse cinders and for the balance use fine gravel, coarse sand, or cinders. The top inch or two may be replaced as often as necessary. During suitable weather, part of the feed hoppers and waterers may be placed in the run.

Sufficient hopper space is of great importance for confinement-reared birds. The recommendations on page 39 should be carefully followed.

It is extremely important that waterers be plentiful and constantly full of clean water. According to size, supply two to four for each 100 pullets. Wash the waterers at least once daily. Place them on a wire platform four to eight inches high and cover with one-and-one-half-inch-mesh, 16-gauge wire or hardware cloth.

When growing "out-of-season" birds in confinement, lights should be supplied to make a 13-hour or 14-hour feeding day. The use of lights in the afternoon is recommended. However, if the confinement-reared pullets are housed in a building where another system of lighting is being used for the layers, that same system can also be used.

Feeding Growing Pullets

Complete-Ration System

Begin feeding pullets Wirthmore Complete Growing Ration at 9 to 12 weeks of age whether they have been fed Wirthmore Complete Chick Starter and Broiler Ration or Wirthmore Baby Chick Starter.

If the poultryman who started with Wirthmore Baby Chick Starter wishes to change to the complete-ration system he should, in the interval between 6 weeks and 9 to 12 weeks, use Wirthmore Complete Chick Starter and Broiler Ration. From these same flocks the cockerels should also be changed at six weeks to Wirthmore Complete Chick Starter and Broiler Ration.

Do not continue to feed Wirthmore Complete Growing Ration after pullets have reached ten per cent production. Although pullets continue to grow after coming into production, their nutritive needs are then best served by the use of the laying ration.

We believe that good poultry practice warrants daily feeding of mash, allowing the pullets to clean out the hoppers each afternoon. Do not continually put fresh mash on top of old feed.

Scratch-and-Mash System

If Wirthmore Baby Chick Starter was used, start feeding Wirthmore Growing Mash at six weeks and continue until the birds reach ten per cent production.

If Wirthmore Complete Chick Starter and Broiler Ration was fed during the brooding period, commence feeding Wirthmore Growing Mash at the 9th to 12th week and continue until the birds reach ten per cent production.

Feed Wirthmore Intermediate Scratch from the fourth or sixth week to the eighth week.

After the eighth week change to Wirthmore Scratch.

Feeding Scratch Grain

Scratch grain may be fed according to one of three methods:

1. Scatter on the ground once daily in the late afternoon all the scratch grain that the birds will clean up before dark. The feeding should be done on a clean spot each day, starting near the shelter or house and moving toward the cleaner part of the range. Some of the scratch is put in hoppers on top of the mash and some directly on the ground.
2. Keep a constant supply before birds at all times in hoppers similar to those in which mash is fed.
3. Combination of the above two methods is common practice. A supply of the scratch is kept in hoppers at all times and a small quantity fed by hand late each afternoon to avoid the crowding which usually occurs around the hoppers shortly before pullets go to roost.

Pellet Feeding

Under certain conditions it is advisable to supplement the growing ration with Wirthmore Fleshing Pellets.

By "certain conditions" we mean those brought about by disease such as any respiratory disease, or when pullets have suffered a setback due to coccidiosis or to internal parasites such as roundworms or tapeworms.

In fact, the supplementary feeding of Wirthmore Fleshing Pellets is recommended at any time when pullets for any reason are not consuming sufficient feed or fail to make normal growth as they approach maturity.

Feeding Confinement-Grown Pullets

Feeding confinement-grown pullets is essentially the same as feeding those grown on the range. Where growing mash and scratch grain are fed, special care should be taken to avoid overfeeding of scratch grain. The complete-ration system has proved well adapted for pullets grown under confinement conditions.

If for any reason the pullets are not in good flesh as they approach maturity, the use of Wirthmore Fleshing Pellets at the rate of three to four quarts daily for each 100 pullets will prove helpful. Change from growing ration to laying ration when production reaches ten per cent.

"Clean-Up" System of Feeding

The "stop-and-go" or "clean-up" system, as it is called, is gaining in popularity. By this we mean feeding only such quantities as will be cleaned up about the middle of the afternoon, or else closing the hoppers at that time. This encourages the birds to scatter over the range and to forage for food. Toward evening they are again fed or else the hoppers are opened.

This method works equally well with either the complete-ration system or the scratch-and-mash system, although more time for eating before going to roost should be allowed if the complete-ration system is followed.

Of course the "clean-up" method is most valuable when there is plenty of room and when the range is well covered with green grass.

Grit

A constant supply of granite or mica grit in a hopper or some other suitable container should be before the birds during the entire growing period.

Oyster Shells

One month before pullets start laying, oyster shells or calcite grit should be constantly before them in order that the pullets may build up the required calcium reserve before laying and hence prevent or at least minimize the occurrence of soft-shelled eggs, prolapse and cannibalism.

Changing the Feeding System

It is possible to change systems of feeding growing birds at any age if the change is made gradually. The best time is either at the finish of the brooding period or when egg production starts.

If the change is from the scratch-and-mash system to the complete-ration system, the mashers can be changed in from three to four days, but the scratch feed should be taken away very slowly. Gradually reduce the daily feeding for a period of at least two weeks.

If the change is from the complete-ration system to the scratch-and-mash system, take three or four days to change the mash, and then start feeding scratch grain, gradually increasing the quantity each day until the desired consumption is reached.

Changing to Laying Feed

We recommend feeding Wirthmore Growing Mash or Wirthmore Complete Growing Ration, as the case may be, until a level of ten per cent production has been reached, except in the case of late-hatched pullets which should be changed earlier in order to encourage egg production at a normal age.

If the pullets are grown on range and housed when production is ten per cent, then *after* the pullets are housed a change is made to Wirthmore Laying Mash or Wirthmore Breeder Mash if the scratch-and-mash system is to be followed, or to Wirthmore Complete Egg Ration or Wirthmore Complete Laying Ration if the complete-ration system is the choice.

Housing

Pullets should not be left on range after production reaches ten per cent. Put the more mature pullets in pens by themselves and, if convenient, leave the later maturing birds on the range a week or two longer.

Regardless of age, spring-hatched pullets should be housed in New England on or before November 1.



The LAYING FLOCK

Management and Feeding

Material contained in this section pertains only to laying birds housed in regular laying houses and fed and managed primarily for the production of market eggs.

Laying Quarters

Generally speaking, birds are confined in their laying quarters for a period of six months to a year. Thus, it is of paramount importance to provide laying quarters which are conducive to the comfort of the birds.

Here in New England it is well to bear in mind that birds in laying quarters are subject to extremes in temperature. Proper construction of the laying houses and correct arrangement of equipment are essential if the birds are to be made comfortable by protecting them from these extremes in temperature.

Up to recent years, poultry-house construction here in New England was mostly of the "open-front" type. As the name indicates, this means that the south side of the houses had fronts which were mostly curtained and which were kept open the greatest part of the time. Whenever poultrymen attempted to close these houses up in order to keep out the cold, they immediately ran into the difficulty of damp litter. Poultry-house construction in New England today reflects the poultryman's de-



sire to keep the laying quarters warmer in winter and cooler in summer.

In order to accomplish this end, it is necessary that all outside walls be double, with either an air space of three to four inches between the studding or this space packed with shavings, sawdust, etc. The inside wall may be made of wood or one of the many satisfactory brands of insulating board which are on the market.

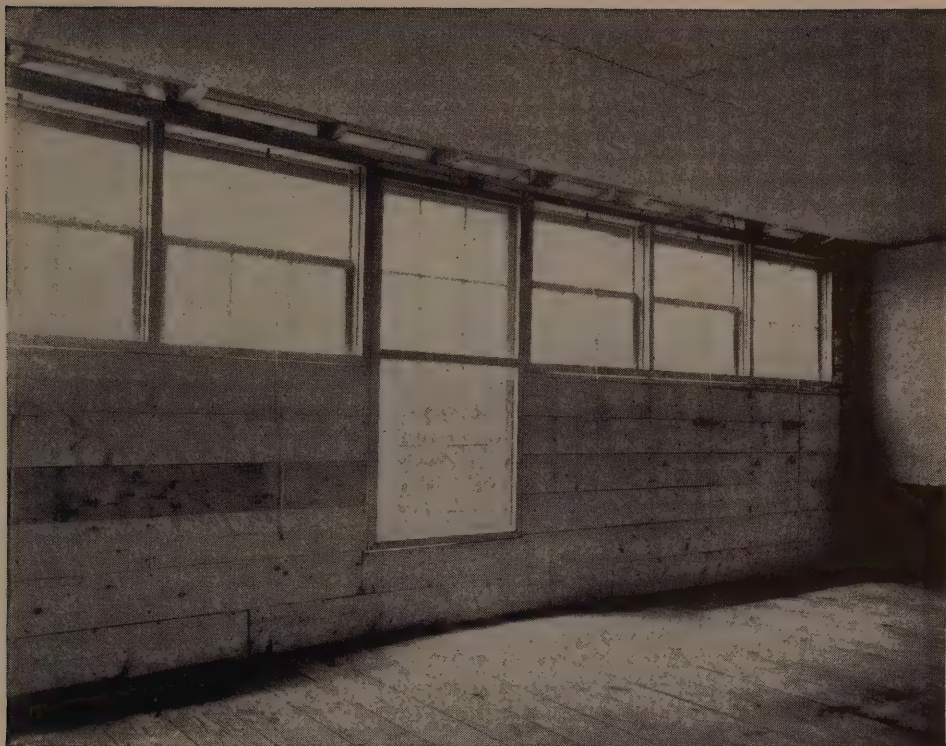
When making over an old house or building a new one, the poultryman must bear in mind that not only the outside walls but also the roof must be of double construction. The roof will then have a false ceiling, and there will be an air space between this false ceiling and the roof itself. Partitions inside of buildings do not require this type of construction, neither does the ceiling between two-story and three-story houses need to be of double thickness.

The arrangement of windows and other openings in the south side of the laying house can be made to conform to the particular type of house used. After insulating the outside walls, the use of more glass or glass substitutes in place of curtain fronts will help to make better conditions in the laying quarters. The houses will be warmer and the litter drier during the winter months. Of course, all glass windows on the front side of laying quarters should be removed during the summer months (June to October). Insulation, of course, serves a dual purpose. It keeps laying quarters warmer in winter and cooler in summer, and also tends to even up variation in temperature between day and night.

Judgment must be used in the operation of these more or less closed fronts. Generally speaking, they can be kept closed during cold and stormy weather to a much greater extent than could the old-type, open-front houses and still maintain dry, satisfactory conditions for the birds.

There are many other ways of making laying quarters more comfortable than by going to the expense of reconstructing them. In many instances, more intelligent handling of litter brings about more desirable conditions in the laying house. Giving thought and attention to the ever-present problem of water receptacles and the spillage around them has been the means of keeping laying quarters in old houses much drier.

Up-to-date plans for building various types of laying houses are available free of charge through your Wirthmore dealer or by writing direct to Wirthmore Feeds, Malden, Mass. On the average poultry plant a small investment of money will frequently provide more comfortable quarters for laying birds. Alterations made on the present laying quarters may prove one of the cheapest and most effective ways of increasing egg production and profits.



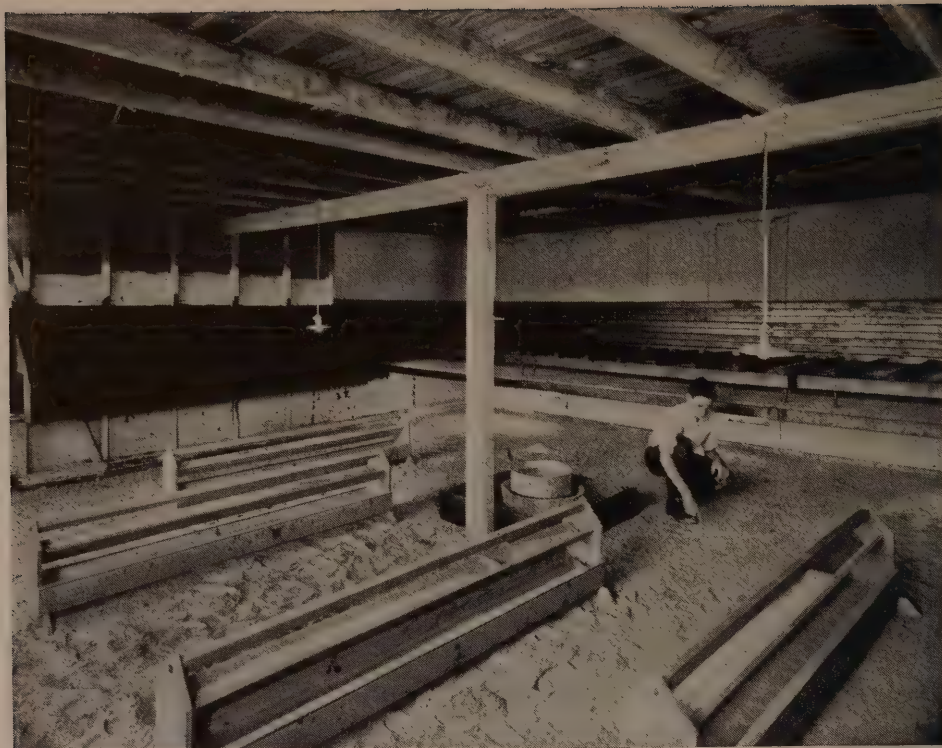
Interior of a 20' x 20' pen in a laying house which was remodeled two years ago. Originally constructed fourteen years ago, the house was what is known as the "Massachusetts and New Hampshire open-front" type, with a two-thirds span roof. Prior to remodeling, the house proved cold in winter. When an effort was made to keep it warmer by closing it up, the immediate result was wet litter.

Note that in remodeling, the outside wall was insulated; a false ceiling made of insulating board; the front double-boarded half way up, with glass used for the upper half; and rafter ventilation employed.

Since the house was remodeled, the pens have proved entirely satisfactory. The cost of remodeling the pen pictured above was about \$35.00.

Location of Roosts and Dropping Boards

Until recent years dropping boards and roosts were always placed against the back wall, permanently and tightly. Where dropping boards and roosts are used at the rear of the laying quarters, they should be set away from the rear wall at least six inches. This allows circulation of air under the dropping boards, up the back wall to roof, along the roof or ceiling, and out the front of the house. This does not create a draft directly on the birds, but does furnish fresh air. This arrangement is a great advantage in hot weather as it keeps the birds much cooler at night. It also proves a big help during the cold weather by reducing dampness. Roosting tables are proving very satisfactory, and on many plants have solved the problem of wet litter. They are located two or three feet from the outside walls.



This pen was built about eight years ago and has been in constant use ever since. Note that it is all ready to receive its quota of early-hatched, five-and-one-half-month-old pullets that are laying at the rate of about 10% (picture was taken July 1st).

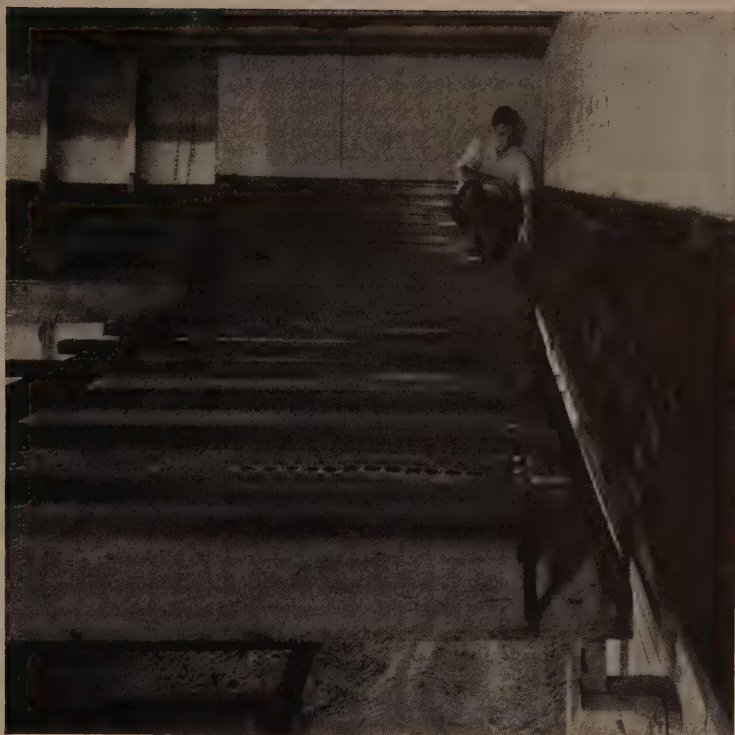
Note that the floor is covered by two inches of screened sand. This is the only litter used until cold weather arrives, and it is not removed until the following April.

The four hoppers are each seven feet in length and provide a total of fifty-six feet of feeding space. The pen itself is 24' x 24' and ordinarily houses 165 birds.

Another means of taking care of the birds at night that is proving quite popular and satisfactory is the use of manure pits in place of dropping boards. The use of manure pits has the advantage of reducing labor involved in removing the droppings. The droppings should be cleaned out about once in two months. Pits allow a freer circulation of air at the rear of the pen. This tends to help solve the wet-litter problem.

Many poultrymen feel that by installing manure pits in their laying quarters they will cut down on the capacity of the pens. Other poultrymen believe that this is not the case. They feel that the floor space under dropping boards is a very poor place for birds to congregate. They prefer to have their birds roost part of the day.

It is important in making over or building new dropping boards, roosts, and manure pits to be sure that they are low enough so that the birds are not mechanically injured in flying to and from them. They should be built not over 30 inches from the floor. This would mean two feet from the top of six inches of litter.



Dropping boards and roosts in a 24' x 24' pen.
They are set six inches away from the rear wall.

The roosts should always run from front to back of the pen, not from side to side. This manner of construction eliminates the crowding of birds on the front roost and better distributes the birds on the entire roosting area. All roosts, whether over dropping boards or manure pits, should be wired so that the birds do not have access to the droppings. The wire recommended is the 16-gauge, one-and-one-half-inch-mesh fox wire or a heavy-welded one-by-three-inch wire. Where dropping boards are used, we recommend that the droppings be cleaned out at least once a week. Roosts should always be at least 12 inches and preferably 14 inches apart on centers.

In order to control red mites, roosts should always have an application of roost paint such as carbolineum, creosote, gas drip, or crank-case oil with the addition of ten per cent crude carbolic acid. It should be applied at least a week before the pullets are to be housed in order to permit thorough drying.

Allow at least six inches of roosting space per bird for Leghorns and eight inches of roosting space for Reds, Barred Rocks, and other types of heavy breeds.

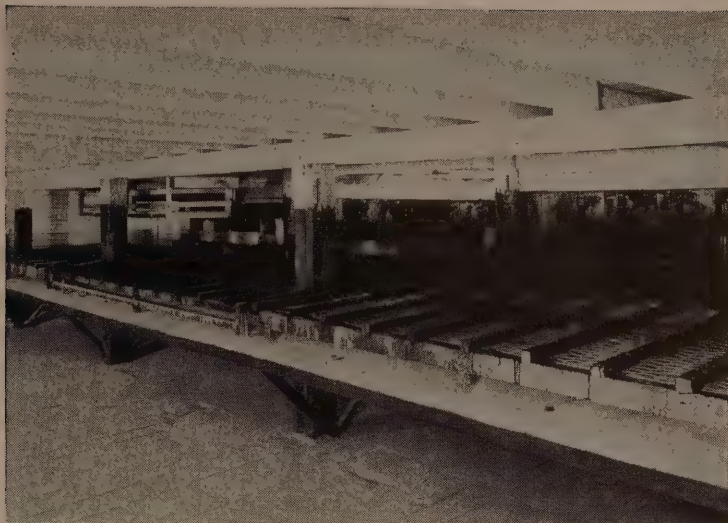


Well-constructed manure pits in a barn remodeled into a laying house. These pits are constructed on the side walls rather than the rear wall.

Each pen is 18' wide and 36' deep. More roosting space was secured by building the pits against the side walls instead of the rear wall. The only means of entering the pen is through an alleyway at the rear. This would have cost another three feet of roosting space had the pits been built against the rear wall. For the past two years, the pen pictured above has provided entirely satisfactory quarters for laying birds.

Roosting tables in another laying house made out of a barn. Note that these roosting tables are set away from the side walls about two feet and permit a good circulation of air at all times. The pen has been used successfully for several years and no difficulty has been experienced with wet litter. The only ventilation is over the rafters in the front or south side of the pen.





Dropping boards and roosts in still another laying house made out of a barn which was 38' deep.

The nests are located on the rear or north wall behind the roosting quarters. Each of the eight pens in this made-over barn is 30' wide and 38' deep and each of these eight pens has housed 275 layers during the past six years.

Although rafter ventilation on the front of the building is all that is employed, the pens have been dry and comfortable, and the birds have made a good laying record.

Originally, the dropping boards were fastened to the rear wall and the pens had to be cleaned several times during the winter because of damp litter. When the roosts were moved $3\frac{1}{2}'$ from the rear wall and the nests attached to the rear wall with a $2\frac{1}{2}'$ passageway between nests and roosts, the increased air circulation eliminated the problem of damp litter.

Nests

Where the roosts are against the rear wall, nests should be located on the side walls of the laying quarters. Where roosting tables are used and set away from the rear wall, the nests may be located against the rear wall. Under no circumstances should nests be located under dropping boards.

Concealed, undivided nests are preferable as they are dark, the birds are not disturbed, and there is less breakage of eggs. Furthermore, they tend to cut down losses from prolapse due to the fact that birds in the pen do not have as good an opportunity to pick at the protruding oviduct before it draws back into normal position.

Where individual or divided nests are used, one should be provided for each four to five birds. Where the concealed trough-type nests are used, 20 running feet for each 100 birds is sufficient. A dividing board three to four inches high should be placed every six feet in these trough-type nests. This arrangement tends to discourage the birds from crowding into the two ends.



One of the two concealed, undivided nests 14 feet in length located in a 24' x 24' pen which houses 165 birds.

Note that there are no partitions. When the cover is down the nest is dark. The birds in the nests are not disturbed by the others in the pen or by the poultryman when doing his routine chores.

Shavings are the best and most commonly used nesting material. It is necessary to frequently replenish it as the birds are inclined to track it out quite rapidly.

At least a week before pullets are to be housed, wooden nests should be given an application of red-mite destroyer.

After the first warm spell the following spring, watch closely for signs of red mites, and if any appear, another application of the red-mite destroyer should be made. Poultrymen should bear in mind that red mites are more of a problem on new wood than on wood that has been treated with two or three applications of mite destroyer.

Feed Hoppers

All feed hoppers should be constructed so that they are near enough to the floor to permit the birds to eat readily from them without having to jump onto a stand. Provide at least one foot of feeding space for every three birds. Only open-type hoppers, so arranged that birds can eat from both sides, are recommended. Always place hoppers toward the front of the pens and set them so that the ends face the front and

the rear of the pen. This provides good light on both sides, and the feed in the hoppers is not shaded by the birds when they are eating. The most convenient length for feed hoppers is six to eight feet.

While we recommend daily feeding of mash, some poultrymen find it inconvenient to refill their hoppers each day. In that case, barrel-type feeders or other feeders holding a larger supply of feed may be used with satisfactory results.

Water Receptacles

The open-pan type of water receptacle is recommended. Cleaning is simple, and it is an easy matter to see whether or not the birds have an ample supply of water available. Where running water with automatic floats is used, one water receptacle is sufficient for pens up to 150 birds. Where birds are kept in units of more than 100 and where running water is not used, at least two water receptacles should be provided. They should be set on wire platforms that are at least one foot larger all around than are the water receptacles themselves.

A tub one foot larger in diameter than the water receptacle should be placed on the floor under the wire platform on which the receptacle rests. This tub will catch a goodly portion of the water that drips off from the edge of the waterer and from the bills of the birds when they are drinking.



A very satisfactory watering arrangement in a pen 24' square. The wire frame is 3' square and 8" high. The pan resting on top of the wire is 17" in diameter and holds four gallons of water. See score card on page 28.

Good absorbent litter should be placed under the wire platforms. This litter directly underneath and close to the platforms should be cleaned out weekly, and a fresh supply put in. The question of water receptacles is an important one in relation to keeping laying pens dry. Many devices are used successfully to catch the drip, and the water which is shaken from the beaks of laying birds.

Shell and Grit Feeders

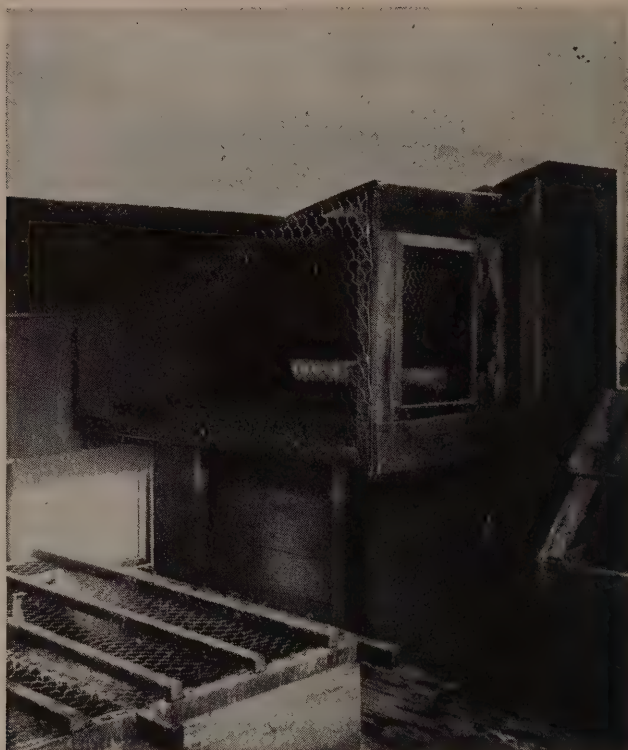
Shell and grit feeders must be provided unless a place is available in the feed hoppers for this material. It is recommended that space for the shells and grit be provided in the hoppers themselves.

Broody Coops

On one of the side walls or one end of the roosts a broody cage should be provided. One of the easiest ways to lower egg production, especially during the spring months, is to neglect breaking up all broody birds. These broody birds should be picked up twice a week and confined in broody cages for three days during which time they should be provided with plenty of water and feed, and handled carefully.

Wherever it is possible for the poultryman to do so, an even better way to handle broody birds is to pick them up every night about dark and confine them in the broody coop until late the following af-

Well-constructed broody coop built against the back and side wall of the pen. This broody coop has a wire bottom. A mash hopper and water container are provided. Since this broody coop is composed mostly of wire, less trouble from red mites is experienced than would be the case if a wooden coop was used.



ternoon, at which time they are let out. Those that have not been entirely broken of the broody habit will go back on the nest, be picked up a short time later, and put back in the broody coop. After three or four such experiences, the broody birds will "break up."

Litter

Regardless of whether floors are of cement or wood or whether pens are in one-story, two-story, or three-story buildings, when the pullets are housed the basic litter should, preferably, be screened sand or gravel put in at a depth of one to two inches. No other litter is used during warm weather, but as cold weather approaches, some such material as peat moss, shavings, sugar cane, straw, etc. should be added in small quantities weekly until a depth of about six inches has been built up. After this quantity of litter has accumulated on the floor of the house, it should be stirred up each week. Litter under and around water receptacles, and that in the front of the house near the windows should be replaced as soon as it becomes wet. This method of handling the litter problem in laying quarters does much to overcome difficulties caused by wet and damp litter.



Not a "brand-new" laying house but one built several years ago and remodeled in the following way:

Old-style open fronts were removed and glass substituted. All outside walls were double-boarded as well as the top-floor ceiling.

As a result the house is warmer in winter, cooler in summer, and dry at all seasons of the year. The birds are more comfortable and egg production has stepped up.

Where poultrymen are successful in keeping the laying quarters dry during cold weather, there is no need whatever for cleaning out the old litter and replacing with new until April or May. If the litter does become damp, the birds will be more comfortable and will usually do better if the wet litter is cleaned out and replaced as often as necessary to maintain dry, sanitary conditions in the house. For the summer use either a light coating of sand or gravel or other suitable litter.

Artificial Lights

The use of artificial lights in laying quarters is a benefit and a good investment. Electric lights tend to increase egg production during the shorter winter months and also are a factor in helping to maintain a high degree of health in the laying flock. Lights should be used to provide approximately a 12-hour to 14-hour feeding day.

Experimental evidence has shown that lights have an effect upon certain glandular activities in the birds, resulting in better health and better egg production. The use of lights also tends to increase feed consumption. These facts indicate the importance of providing sufficient lights so placed in the house that the rays will shine directly on the birds.

Be sure that sufficient lights are used to produce the desired results. Provide at least a 40-watt lamp and outlet for each 200 square feet of floor space in the laying pens. Lights should be located approximately six feet above the floor and be equipped with a reflector.

Automatic devices for turning lights on and off are reasonable in cost and efficient. They can be set to take care of any system of lighting. Listed below are the various systems of lighting in order of our preference. Except with the morning light and the all-night lighting systems, a dimming device is necessary in order to get the birds to roost.

First. Afternoon and morning lights.

This means turning on lights in the afternoon when it begins to get dark and shutting them off at 7 P.M.; then putting them on again the next morning at 6 o'clock and burning until daylight.

Second. Morning lights.

This means turning lights on at from 3 to 4 o'clock in the morning and burning until daylight.

Third. All-night light system.

With this system 15-watt bulbs are used in place of 40-watt bulbs; turned on as darkness approaches in the afternoon, and burned until daylight the following morning. This system is used principally on yearling hens to help bring them back into production.

Fourth. Evening lights.

Lights are turned on in the afternoon as it gets dusk and not shut off until about 8 P.M. No morning lights.

Fifth. Evening lunch system.

Lights are turned on for an hour from 9 to 10 o'clock at night.

Summer Laying Shelters

A sufficient number of these buildings to take care of layers from the first of June until the first of November proves a paying investment over a period of years. One of these shelters in the size pictured will accommodate up to 350 birds.

Summer laying shelters should be located with a limited yard where

there is shade for the birds. Feed and water should be available in the yard as well as in the shelters themselves. These shelters provide cool, comfortable quarters during the hot summer months.

The labor involved in caring for birds in summer shelters is far less than in a regular laying house. Furthermore, the regular laying quarters can be thoroughly cleaned and repaired, and everything made ready to house the new crop of pullets as they come into production.



Summer laying shelter with plenty of shade, feed and water available both inside and out. Detailed plans for building this shelter are available free of charge. See page 181.

Laying birds moved to summer laying shelters during the months of May or June are upset in production only temporarily by the moving. It is not advisable to move laying birds after the first of July as in many cases it will result in throwing them out of production and into a molt. As a rule, layers will continue in better production during the hot summer months under the comfortable environment provided by these summer laying shelters.

When and How to House Your Pullets

When should pullets that are out on range be housed in permanent laying quarters? Our recommendation is that pullets be put into permanent laying quarters as they come into production. There are several reasons for this, three of the more important being:

First. The nutritive requirements of pullets coming into production necessitate a change from growing mash to laying mash. As a rule, it is not convenient to make this feed change on the range.

Second. Rarely will pullets eat sufficient feed on range to maintain a continued increase in weight and at the same time produce eggs at a fairly high rate. In

other words, when birds are housed, their feed consumption is automatically stepped up.

Third. Pullets that are housed at this time will more quickly become accustomed to their quarters and more readily use their nests, thus reducing the number of floor eggs and the tendency towards cannibalism.

It is highly desirable to select and house pullets according to their stage of sexual development. It is rarely that a lot of pullets will all show signs of coming into production at the same time. Plan to make three selections and three housing operations with each lot of pullets that is on range. When the flock has reached ten per cent production, make the first selection. When the balance of the flock left on range again reaches ten per cent production, make the second selection. Repeat this procedure for the third and final selection. By so doing, birds of about the same development and general condition are housed in the same pens in the laying quarters. This tends to overcome "bossism" which is quite prevalent if pullets of various stages of sexual development are housed in the same pen. Furthermore, it helps the poultryman to keep a closer check on feed consumption and body weight.

Whether they are in production or not, pullets from chickens hatched late in the season are probably better off if housed in their laying quarters here in New England by the first of November. Early-hatched and mid-season-hatched pullets should be housed according to directions given previously.

Grade, cull, and select pullets carefully at housing time. If there is ever a time that a poultryman should be "hard boiled" in culling his birds, it is when he is housing his new crop of layers. He will actually save money if a more or less border-line doubtful pullet is sold for meat and not given valuable space in his laying quarters.

Probably the most satisfactory time to bring in pullets from the range is at night. Be sure that each pullet is put on the roost when brought in. Then for the next few nights make certain that they roost properly. If this is done and if all pullets are made to go on the roost right from the start, they will not acquire the bad habit of roosting on hoppers, water stands, nests, and even piling up in the corners on the floor.

Another point of importance is to be sure that both feed and water receptacles are placed on the floor of the laying pens during the first few days after pullets are housed. Generally speaking, all feed and water containers used on the range are placed down on the ground. Birds, consequently, are not accustomed to having to fly up onto feed and water stands.

Another very important management problem that is often troublesome is to get the pullets down from the roosts the morning after housing. The birds are unaccustomed to their new surroundings, particularly the change from surface range conditions to the loose, light-

colored litter material often used. They are afraid of the litter and sometimes will hang to the roosts for two or three days without feed or water because of this fear. This is one of the reasons for recommending sand or gravel on the floor of laying pens and the addition of no other litter until later in the season. If litter other than sand or gravel is used, start with a very light coating and build up the litter after the birds become accustomed to it.



South side of a laying house as it looks on a cold winter's day. Note first the small slot about one inch wide just above the floor in each pen. Fresh air enters this slot, comes up between the double boarding and into the pen at the level of the window sills. Then note the overhang and the rafter ventilation which allow the hot, moist, foul air to escape from the pen.



The same house on a hot day in summer.

One other management problem that must be handled carefully at housing time is that of providing plenty of fresh air in the permanent laying quarters. By and large, the pullets have been taken from range quarters where they had an abundance of fresh air. For the first few days, at least, the same conditions should more or less exist in the per-



These two views show the laying house, permanent brooder house, and range on a poultry plant where the keeping of 2500 layers is the means of livelihood and the principal occupation of the owner.

Scattered throughout New England are hundreds of these commercial poultry plants that have provided a good living for their owners over a long period of time. The Wirthmore organization is proud to be able to number so many of these poultrymen among its friends and customers.

These pictures and others elsewhere in this book serve to show some of the reasons why printed information on the management of poultry must be more or less general in nature. Every poultry enterprise has its own particular problems. The Wirthmore Poultry Service representative in your section is available to talk your problems over with you and to offer his suggestions. Requests for a visit from a Wirthmore Poultry Service representative should be made through the nearest Wirthmore dealer.



manent laying house. Do not close up the openings on the front side of the house until pullets have been housed for some little time. Good judgment must be used in the operation of windows or ventilator openings other than those on the front side of the laying quarters, and adjustments made according to season.

Still another point of primary importance in housing pullets as they come to maturity is to realize that their reproductive organs are a very delicate combination of tissue and muscle and can be easily ruptured, misplaced, and permanent damage done if the birds are not handled carefully. Therefore, when handling pullets at housing time, be sure that they are handled carefully when put into the pens and that this same care and caution is practiced in caring for the birds in their new laying quarters until they get over their nervousness.

The proper number of birds to house in any size of laying pen is determined by allowing four square feet per bird. Under no conditions should the number of square feet per bird be less than three.

Floor Space	Number of Birds	
	Breeds — Light	Heavy
12 by 16	45 to 50	35 to 40
20 by 20	110 to 125	100 to 110
20 by 30	185 to 200	150 to 175
24 by 24	185 to 200	150 to 175
30 by 30	300 to 325	250 to 275
30 by 40	400 to 425	375 to 400

Delousing

As soon as pullets have become accustomed to roosting, they should be examined and, if necessary, treated for the elimination of body lice. Today this is an easy, inexpensive job.

Two applications of a good lice paint will, as a rule, keep the birds free from lice during the laying year. Just before dark fill an ordinary oil can with the lice paint and squirt a line of it on the top side of all roosts, or apply with a brush. Then see to it that all birds in the pen occupy space on these roosts that night. If this application is repeated again seven days later, any lice that have hatched out during the interim will be killed. The following spring examine the layers carefully for the presence of body lice. If any are found, repeat the application again at that time.

Culling

Assuming that a thorough culling and selecting job was done at the time the pullets were put in laying quarters, there is no definite schedule as to the frequency with which a poultryman should handle and cull his entire flock of layers. Good poultrymen are continually removing undesirable birds from their laying pens. This is a sound and

economical practice. As they go through their laying pens, poultrymen should observe and remove immediately any birds which show indications of being undesirable to keep from a health or production standpoint.

A Culling and Selection Chart FOR JUDGING PRESENT PRODUCTION

<u>Indications</u>	<u>Laying Hen</u>	<u>Nonlaying Hen</u>
Vent	White, large, oblong, moist	Small, round, yellow, dry
Comb	Large, red, full, silky	Small, pale, scaly
Pelvic Bones	Wide apart, pliable	Close together, rigid
Wattles and Earlobes	Prominent, soft	Shrunken, rough, dry

FOR JUDGING PAST PRODUCTION

	<u>Laying, long duration</u>	<u>Laying, short duration</u>
Vent	Bluish white	Flesh-colored
Eye-rings	Thin, edges white	Thick
Eyes	Prominent, sparkling	Listless, sunken, dull
Beak	White	Yellow-tinted
Face	Lean, free from yellow color	Beefy, or hollow, yellowish
Shanks	White, thin, flat	Yellowish, round, full
Plumage	Worn, dry, close-feathered	Smooth, oily, signs of molting, loose-feathered

FOR JUDGING RATE OF PRODUCTION

	<u>High producers</u>	<u>Low producers</u>
Keel	Long, slopes downward	Short, slopes upward
Back	Long, broad, width carried back	Short, narrow
Body	Deep, both front and rear	Shallow
Heart Girth	Wide	Narrow
Capacity (Pelvic bones to keel bone)	Deep (four to five fingers)	Shallow or full of hard fat
Abdomen	Soft, pliable, full	Fatty, hard or contracted
Pelvic Bones	Thin, flat, pliable	Thick, round, rigid
Shanks	Thin, flat, dry	Round, full, smooth
Skin	Loose, thin, soft	Thick, underlaid with fat
Plumage	Close-feathered	Loose-feathered
Comb	Smooth, velvety, full	Shrunken, rough
Head	Deep, flat, wide, width carried well forward	Slopes, long, narrow, beefy
Beak	Broad, short, and stout	Narrow, long and thin
Eyes	Prominent, keen, set well apart	Small, sunken, turning toward beak

Feeding Instructions

In general, laying birds are being fed today according to two systems of feeding:

First. What is known as the complete-ration system, where the feed is entirely in mash form and where no scratch grain is fed.

Second. The scratch-and-mash system, where both scratch grain and mash are fed.

In feeding laying birds the all-important point is to make every effort to have the birds partake of sufficient feed. There is no schedule giving exact quantities to feed as the quantity varies with the breed as well as the strain within the breed, also with the age of the birds, their housing conditions, and particularly with their rate of production.

Leghorns and other breeds in the Mediterranean class require less feed than do Reds, Rocks, and others in the American and heavier classes.

Years ago poultrymen used to talk about 25 pounds of feed per day for each 100 birds as the maximum. Today, because of heavier production, we know the maximum figure according to breed and production will run to 30 pounds or more of feed per day. The poultryman's real problem is to have his birds eat sufficient feed to maintain or increase their body weight, and at the same time supply them with sufficient material from which to manufacture eggs at a high rate.



WHITE LEGHORN No. 56B

317 Eggs in 365 Days

(Oct. 18, '36 to Oct. 17, '37)

White Leghorn No. 56B was raised at the Wirthmore Demonstration Farm. She was fed on Wirthmore Complete Laying Ration and given Wirthmore Fleshing Pellets when additional feed intake was needed. From Oct. 18, '37 to Nov. 24, '37 (the last day on which figures were available before this book went to press) she laid 24 more eggs, making a total of 341 eggs in 403 days.

The management practice that will give the poultryman the best picture of the physical condition of his birds is to band and weigh eight to ten birds out of every 100 that are housed. Every two weeks, if possible, or at least once a month, the poultryman should go into the laying

pens, catch these banded birds and weigh them. Pullets should continue to gain in weight from the time they are housed until they are nine to ten months old. This gain in weight amounts to two to four ounces per month.

At times, especially under adverse circumstances such as short days, hot and cold spells, disease conditions, etc., it is essential for the poultryman to resort to one or more of the management practices listed below in order to take care of the increased feed requirements which the desired level of egg production demands. These management practices are:

First. Placing small quantities of fresh mash in the hoppers one or more times a day, or stirring up the mash already in the hoppers. Either of these practices encourages feed consumption.

Second. Making sure, when the scratch-and-mash system is followed, that the proper quantity of scratch grain is fed and that a correct balance between consumption of scratch and mash is maintained.

Third. Using electric lights to lengthen the feeding day. We recommend the use of electric lights to maintain a 12-hour to 14-hour feeding day under all conditions in laying flocks.

Fourth. Feeding pellets — a concentrated, palatable feed, which is readily consumed by laying birds as soon as they become accustomed to it.

Fifth. Feeding moist mash, if preferred in place of pellets. Moist mash is palatable and encourages additional feed consumption.

Sixth. Placing a small hopper filled with mash on the roost. Frequently this will provide a means for the more timid birds to increase their feed consumption.

Complete-Ration System of Feeding

Poultrymen feeding their layers on either Wirthmore Complete Laying Ration or Wirthmore Complete Egg Ration will not find it necessary to resort to the use of scratch grain at any time. Wirthmore Fleshing Pellets are to be used when the need arises for added feed intake. If pellets are not used, moistening some of the regular ration is another means of encouraging greater feed consumption.

Best results will be obtained by putting in the hoppers about the quantity of Wirthmore Complete Laying Ration or Wirthmore Complete Egg Ration that the birds will clean up daily. Allowing the hoppers to become empty for a short time in the afternoon and then replenishing them with a supply sufficient to last until about the same time the next day is, we believe, the ideal way to feed either Wirthmore Complete Laying Ration or Wirthmore Complete Egg Ration. However, where this method is not possible, satisfactory results can be obtained by keeping a constant supply of the complete ration before the birds at all times.

Pullets that are to be fed on either Wirthmore Complete Laying Ration or Wirthmore Complete Egg Ration should have the feed available

at about the time production reaches ten per cent. Pullets grown on Wirthmore Complete Growing Ration can be changed to the laying ration immediately. Birds that have been grown on the scratch-and-mash system and are to be fed either Wirthmore Complete Laying Ration or Wirthmore Complete Egg Ration may be similarly changed to laying ration immediately, and the scratch grain gradually cut down until it is entirely eliminated, taking about two weeks to accomplish this. Elimination of scratch-grain feeding is aided by refilling the mash hoppers at the time of day when scratch has been fed. When the pullets approach 50 per cent production, check closely on their feed consumption and body weight. With early-hatched pullets it is advisable to use electric lights by the first of September to help stimulate feed consumption.

The rapid growth in the demand for Wirthmore Fleshing Pellets clearly indicates their success in accomplishing the purpose for which a moist mash was previously fed. Use Wirthmore Fleshing Pellets in such quantities as are required to maintain desired level of total feed intake, not increasing the quantity of pellets fed beyond six pounds (4 quarts) per 100 birds daily. Pellets should be distributed so that all the birds can get some. They may be fed on top of the dry mash or part of them may be scattered in the litter. Probably the best time to feed pellets is at noon as most poultrymen replenish the mash in the late afternoon. The feeding of Wirthmore Fleshing Pellets should under ordinary conditions probably be continued during the period of high production, short days, and cold winter weather. They may be gradually discontinued, however, when the birds are in good physical condition and are eating sufficient of the regular ration.

Feeding a wet mash is more laborious than the use of Wirthmore Fleshing Pellets. A moist mash does not lend itself to continued use. At times a wet mash may not be as sanitary as pellet feeding. Wet mash is fed to increase feed consumption for the same reasons that have been previously discussed. Complete-ration feeders who prefer to use a wet mash will find their regular ration most satisfactory for the purpose.

In feeding moist mash, give the birds the quantity that they will clean up in not over one-half hour. The quantity fed should be sufficient to maintain the desired total level of feed intake but should not exceed six pounds of dry mash per 100 birds daily. The moist mash may be fed on top of the dry mash.

The use of other supplements such as scratch grain in any form, germinated or sprouted oats, or cod liver oil will not be necessary under any conditions. Both Wirthmore Complete Egg Ration and Wirthmore Complete Laying Ration contain an ample supply of all the nutrients to be found in the above-mentioned materials. Inexpensive greenstuff

that the poultryman may have available can be fed in quantities up to five pounds per 100 birds per day. Milk in any form that may be available at a very low cost may be used to good advantage. Here again the quantities should be limited.

Scratch-and-Mash System

Under the scratch-and-mash system, either Wirthmore Laying Mash or Wirthmore Breeder Mash is used, and it is fed in conjunction with Wirthmore Scratch Feed. In feeding either Wirthmore Laying Mash or Wirthmore Breeder Mash, it is kept in hoppers before the birds at all times. A supply of the mash sufficient to last approximately 24 hours should be placed in the hoppers daily.

Wherever it is possible, it is a good idea to let the birds clean up all the mash in the hoppers daily. If they are out of mash for an hour or so in the afternoon at about the same time each day this will do no harm. In other words, it is better to have the layers without mash for a short time each day than to keep putting fresh mash on top of that already in the hoppers.

There are many recognized and satisfactory ways in which to feed Wirthmore Scratch. Its intelligent feeding cannot be done by any set rule as to the number of pounds or quarts to be fed. General recommendations are as follows:

Feed the birds Wirthmore Scratch once a day; feed it an hour or two before the birds would normally go to roost and in such quantities as they will practically clean up in that time. Wirthmore Scratch may be fed entirely in hoppers, it may be scattered 100 per cent in the litter, or part of it put in hoppers and the balance put in the litter.

Under ordinary conditions, the mash consumption as compared to the scratch consumption should be within what is known as a 40 to 60 ratio. This means that, normally, not more than 60% or less than 40% of the total daily feed intake should be mash.

If the problem is to increase mash consumption, it can be done, first, by putting fresh mash in the hoppers oftener than once a day, or by going through the pens and stirring up the mash in the hoppers; second, by cutting down on the quantity of scratch grain that the birds are allowed to have; third, by the proper use of lights; fourth, by feeding Wirthmore Fleshing Pellets; and fifth, by feeding a moist mash if pellets are not used.

If the problem is to increase scratch consumption and if the birds will not eat the required quantity at night, it generally can be accomplished easily by feeding one or two quarts of scratch grain in the morning and a similar quantity at noon to each 100 birds and then feeding all that they will clean up at the regular feeding time at night. Poultrymen feeding scratch and mash must realize that the mash is primarily for the manufacture of eggs and the scratch grain is primarily to maintain the bird. Heavy scratch-grain feeding is not conducive to high egg production but is the means of building up body weight in the flock. If body weight is good and production is low, a general cutting down of scratch-grain feeding and the resulting step-up in mash consumption should result in better egg production.

Wirthmore Fleshing Pellets have a definite value for the scratch-and-mash feeder when he wishes to build up body weight and increase feed consumption. Four quarts daily per 100 birds, fed at noon, is the maximum quantity of pellets to feed. If Wirthmore Fleshing Pellets are not fed to accomplish the purposes just mentioned, the use of a moist mash will produce similar results.

In feeding moist mash give the birds the quantity that they will clean up in not over one-half hour. The quantity fed should be sufficient to maintain the desired total level of feed intake but should not exceed six pounds of dry mash per 100 birds daily. The moist mash may be fed on top of the dry mash.

Under the scratch-and-mash system, feed relatively large quantities of Wirthmore Scratch during cold weather, cutting down on the quantity as warm weather approaches. Feed relatively small quantities of scratch grain during the hot summer months.

In the foregoing section of this book an effort has been made to set forth in a general way the recommended feeding directions both for the complete-ration system and for the scratch-and-mash system. If at any time the poultryman questions whether or not he is using Wirthmore Feeds to the best advantage, he is requested to get in touch with the Wirthmore poultry serviceman who works in his territory and get a check-up on the feeding practices employed.



The winning pen of Barred Rocks at Storrs, 1937. Bred and owned by R. C. Cobb, Old Pickard Farm, Littleton, Mass.

CAGED BIRDS

Management and Feeding

Starting, Growing and Developing Batteries **Starting Batteries**

For brooding purposes, many laying-cage operators use starting batteries exclusively. They are used by some commercial poultrymen for brooding baby chicks for the first two or three weeks, after which the chicks are removed to the floor brooders. Such a plan simplifies the handling of the chicks and makes chick brooding easier, particularly during winter brooding and periods of unfavorable weather conditions. Broiler producers who cater to a rather select dressed-



A Broiler-Raising Plant Equipped Entirely with Batteries.

broiler trade find the battery method of brooding chicks can be used throughout the entire year with satisfactory results. Poultrymen who wish to conserve space, reduce labor, and relieve congestion during the brooding period transfer a part or all of the young males that are to be sold as broilers to the battery brooders where they remain until disposed of. Starting batteries are found to be very convenient and effi-

cient for holding and brooding unsold chicks and "started" chicks. Purchasers of chick battery brooders should not only carefully note that they are well constructed of a nonrusting, durable material, that they are easy to operate and keep clean, but also should observe other important details. The brooders should be so designed that the young birds can easily reach the food and water and should be equipped with nonwasting feeders. They should have thermostatically controlled heaters. It should be possible to raise or lower the hovers to varying levels from the battery floor according to the size of the chicks.

Growing and Developing Batteries

Growing and developing batteries are used when chicks, because of their increasing size, require more floor area, height, and feeding space per bird. Chicks commonly remain in them until sold as broilers or roasters or until the time comes to remove them to individual laying cages.

Battery-Room Requirements

To operate starting batteries economically and efficiently, the room in which they are located should be well insulated and properly ventilated.



Plan to visit the Wirthmore Demonstration Farm, Lynnfield Center, Mass., any day you can except on a Sunday or holiday. Frank Perry, well known to hundreds of New England poultrymen, will be glad to greet you and to show you around the Farm. Controlled feeding tests are an integral part of the program at the Farm. In the chick battery room several thousand chicks can be brooded at one time.

If chick batteries are to be operated successfully, the three major factors—ventilation, temperature and humidity—so essential to good poultry-house management must be given due consideration. Since the battery system makes it possible to brood and rear more birds within a given floor area, this is of top importance. Also the demand for fresh air is greater, and the temperature and humidity requirements are more exacting. In order to permit ample air circulation, which is especially important during hot weather, plenty of ceiling height is needed. The air temperature of the brooder room should be well controlled, and extremes avoided as much as possible.

Supplementary room heat is essential. Facilities for regulating it are also essential. The danger in the starting room of too low temperature is considerably lessened with the modern brooding equipment but the problem of too high temperature during hot weather is still present. Humidifiers may be installed as a part of the battery-room equipment in order to maintain proper humidity.

Ventilation

Good ventilation is a necessity. Provided the battery room is otherwise properly constructed, flues or openings equipped with electric ventilating fans, together with windows that can be adjusted should, under ordinary conditions, furnish adequate ventilation.

Window Space

The number of windows required depends, of course, upon the size and shape of the room and the number of battery sections used. For better light distribution, having the windows placed between the aisles is desirable. Six-light, single-sash windows are commonly used. Only enough light should be provided in the chick starting rooms so that the birds can readily see to eat and drink. Too strong light tends to lead to feather pulling and cannibalism.

Heating

Small installations require only a coal-burning or oil-burning heater equipped with a thermostatically controlled regulator. When large areas are to be heated, a hot-air heater unit with the blower type of forced air circulation, or a series of pipes or radiators carrying hot water and placed on at least two side walls is used successfully for heating the larger battery rooms. Such heating units should also be equipped with thermostats.

When a central heating system alone is employed, day-old chicks are first placed on the upper decks and then moved to the lower decks as they grow so that they are surrounded by the cooler layers of air. When heating units are built into the battery, the hover temperature may be reduced by adjusting the thermostat, making it unnecessary to move the chicks.

Management and Feeding of Battery Chicks

The chick batteries should be spaced about three feet apart, and out from side walls about 15 to 18 inches. When baby chicks are started in batteries with heated hovers, it is best to maintain an average room temperature of 75 to 80 degrees for three days and then gradually reduce it to 70 degrees by the end of the first week. When heated hovers are not a part of the battery equipment, a room temperature of 90 degrees must be maintained during the first few days and then gradually lowered. The type of battery with heated hovers is strongly recommended. A hover temperature of 90 degrees at the start is considered about right, and as the chicks grow older it can be reduced gradually. The temperature requirements of the chicks can be judged quite accurately by their behavior in the battery. When they huddle together in an effort to keep warm, more heat is needed, whereas if they spread out rather evenly underneath the hover, it indicates that they are comfortable. Too high temperature usually brings on feather pulling and cannibalism and retards growth and feather development.

A relative humidity of 70 degrees or slightly higher is probably most suitable for the chick starting room. A wet-bulb hydrometer is a serviceable piece of equipment for measuring humidity. The wet bulb, however, must be wet when the reading is taken. If equipment does not include a humidifier, it is sometimes necessary to wet the battery-room floor in order to maintain the required humidity.

Too much dry air circulating through the starting-battery room will tend to make the feathers brittle, sap the vitality of the chicks, and slow up growth. In some instances it has seemed to prove harmful to parts of the respiratory system.

Overcrowding slows up growth and causes uneven development. This point cannot be too strongly emphasized because the actual capacity of starting batteries is frequently overrated. Lack of hopper space will retard growth and increase production costs.

The cockerels should be separated from the pullets at an early age, preferably about as soon as they can be identified. The pullets are commonly transferred to the rearing batteries at from four to eight weeks of age, depending upon the type of growing equipment used. It is seldom a wise practice to hold the pullets in the starting units beyond eight weeks of age.

Lighting Requirements

The lights must be so arranged that the feed troughs and waterers are well lighted, and shadows avoided as much as possible.

Ordinarily a 12-hour or 13-hour feeding period is sufficient. A longer feeding time is seldom necessary except in rare cases where birds are

to be raised solely for meat purposes and abnormally rapid growth is desired for a short period.

In order to overcome too strong daylight in the battery room, windows are often painted with a red-colored compound. This aids in preventing cannibalism and feather pulling. It is for this same reason that red bulbs are sometimes used when artificial lighting is required.

Feeding Battery Chicks

While satisfactory results can be obtained only when properly balanced rations are fed to battery-brooded chicks, it is also true that economy and efficiency of production are dependent upon the employment of good feeding practices as well.



The text matter in Wirthmore publications is seldom if ever the work of any one individual. Like Wirthmore Feeds themselves, Wirthmore literature represents the combined thought and experience of groups of trained men. Pictured above, busily at work, is part of the group who wrote the book you are now reading.

When the chicks are first put in the batteries, best results are secured by scattering the feed on paper plates, egg-case flats, or heavy pieces of paper placed on the floor of each brooding unit. This plan should be followed for a day or two, or until all of the chicks eat readily from the regular feeding troughs. Some of the latest models of batteries are so constructed that they encourage the chicks to eat out of the hoppers immediately. The troughs should be kept well filled at first so that the chicks can easily reach the feed.

Water should also be made readily available during this time. Placing one or more chick-size water fountains on the floor of the battery for two or three days is a wise procedure.

Either of two methods of feeding may be followed. One is to keep the feed troughs filled with Wirthmore Complete Chick Starter and Broiler Ration, except to allow the chicks to practically empty them twice

each week. The other method is to feed Wirthmore Complete Chick Starter and Broiler Ration once or twice daily in just about the quantity that will be eaten before the next feeding period. A keener appetite may be acquired when such a method is followed. Some hard grit should be sprinkled on top of the mash twice weekly. Oyster shells or other calcium material should not be fed to chicks in batteries during the growing period.

Management and Feeding of Battery Pullets

To successfully grow a crop of pullets in batteries from hatching time to the laying stage requires adequate equipment, skillful management, and correct feeding of a ration so balanced as to fully meet the nutritive needs of the birds. This is obvious when it is realized that growing stock reared under such conditions is deprived of range, green feed, exercise, and other essentials which pullets grown out-of-doors usually receive. Nevertheless, it has been repeatedly demonstrated that good pullets can be grown by the battery system. To condemn the battery method of rearing replacement pullets is to ignore the successful experience of numerous operators. When birds are grown in batteries, faulty management and feeding practices tend to lead to disappointing results even more than with the range system.

Equipment and Housing Requirements

Equipment requirements for the battery system of raising pullets are essentially the same as those for battery brooding. The growing or developing batteries should be durable and efficient to operate, have roomy compartments with sufficient head room so that the birds as they grow larger will be able to eat and drink in a standing position. The cleaning devices should operate easily and efficiently. The watering system should be dependable and furnish a constant supply of fresh water with a minimum amount of care. Feed troughs should be of the nonwasting type and should be easily accessible to the birds. The feeding job should be done in such a way as to require as little labor as possible. The entire battery should be substantially built of rust-resisting material and so constructed as to provide maximum sanitation.

To grow good pullets in batteries requires that the houses or rooms in which the batteries are operated be well insulated so as to provide the necessary means for maintaining the desired temperature as nearly as possible. Similar heating facilities to those used for laying-cage rooms are needed.

Since growing pullets demand a larger supply of fresh air as they grow older, ventilation is of tremendous importance. A free circulation of fresh air without objectionable drafts is necessary. A rapid flow of hot dry air is to be avoided as it may lead to serious trouble.

The batteries should be so placed in the room that caring for the birds can be done conveniently and with the least amount of labor. Allow a space of about three feet between batteries, and an aisle four feet wide at one end. A distance of 15 to 18 inches is usually allowed between the end of the battery and the side wall.

Management

Growing pullets successfully in batteries necessitates giving close attention to numerous essential details pertaining to their care and management. The importance of maintaining three factors—room temperature, ventilation, and humidity—in proper balance, cannot be overemphasized.

The pullets require less heat than do the young chicks, and when they are first transferred, a room temperature of about 60 degrees is considered best. This may be reduced gradually to about 55 degrees or slightly lower as the birds advance in age. This means that a separate room for the growing stock is best.

High room-temperature frequently results in poor feathering, slower development, and lowered vitality. It also leads to such vices as feather pulling and cannibalism. The problem of maintaining proper room temperature becomes more acute during hot weather, and provisions should be made to keep it as low as possible. Cool temperatures tend to encourage feed consumption and promote normal growth.

Sufficient humidity—about 50 per cent relative humidity—can be maintained by frequently sprinkling the floor of the battery room, or by the use of a humidifier.

As the pullets grow older and increase in size, they require a larger supply of fresh air; therefore, adequate ventilating facilities should be provided. Since the battery system of rearing pullets makes it possible to house a much larger number of birds within a given floor area, the necessity of supplying ample ventilation is obvious. As the number of birds per cubic foot of housing space increases, there is a greater demand for fresh air. Air movements should be well controlled by the use of a good ventilating system that can be easily and efficiently operated.

Overcrowding of growing pullets confined in batteries results in uneven growth, poor feather development, and the acquirement of feather pulling and other cannibalistic habits. It may also have a harmful effect on the health of the birds or their production later on.

The quantity of space to allow these rapidly growing birds depends upon the size of the compartments. The number of birds per unit should be reduced as they become older and larger so that they will be more comfortable, and so that the weaker individuals will have a better chance to grow.

The same plan of lighting as is followed during the brooding period may be used during the time that the birds are kept in growing batteries. Some operators find it advisable to allow only diffused light to enter the room in which the pullets are being reared. This can be done very easily by painting the windows with some red-colored com-

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RHODE ISLAND RED

No. 98

273 Eggs in 10 Months,
14 Days

Confined in a laying-cage unit at the Wirthmore Demonstration Farm, Rhode Island Red No. 98 has done quite well, thank you! In exactly 10 months and 14 days after laying her first egg on November 11, 1936, she produced 273 eggs. Her feed was Wirthmore Battery Ration and Wirthmore Laying Pellets.

Laying records not unlike that of Rhode Island Red No. 98 have been made by numerous of her caged sisters at the Wirthmore Demonstration Farm.

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pound. When artificial lighting is needed, red bulbs are used. It is during the growing period that the pullets tend to be more nervous and are easily frightened, causing them to "pile up" and crowd, which may retard growth, lead to an outbreak of cannibalism, or result in permanent injury. This frequently occurs when too strong light is permitted to enter the rearing quarters. It must be remembered, however, that the light should be sufficient at all times so that the birds can readily see to eat and drink.

Frequent removal of droppings and the cleaning of waterers and feed troughs are a part of a well-planned sanitation program to be followed as an aid toward safeguarding the health of the growing flock.

Battery-reared pullets may be transferred from the batteries to the laying-cage units at any time from 12 weeks of age up to the time they commence to lay. When the transfer is not made until the birds are about ready to lay or are laying, less hen-battery space will be occupied by nonproductive individuals but more developing-battery space is required. On the other hand, if changed to laying batteries earlier, the young layers have an opportunity to get accustomed to their new laying quarters before production starts.

If vacant hen cages are available, it seems advisable to transfer the ready-to-lay birds to them two or three weeks prior to the time actual egg production is anticipated.

Feeding Battery-Reared Pullets

The feeding of battery-confined pullets during the rearing period does not differ widely, in so far as acceptable methods are involved, from that used during the brooding stage. The complete-ration system is the one followed most universally because it not only requires less labor than does the scratch-and-mash method, but invariably gives better results. Wirthmore Complete Growing Ration should be fed commencing at seven to nine weeks of age and continued until production reaches ten per cent.

As the pullets are approaching production, Wirthmore Fleshing Pellets may be fed with Wirthmore Complete Growing Ration if, for any reason, it is necessary to improve their flesh condition at the time production begins. Three weeks is usually a sufficient length of time to secure the desired body weight. The pellet feeding should be discontinued soon after laying starts so that it may be used again later on if needed.

A constant supply of hard grit (mica or granite) should be furnished, but no oyster shells or other calcium material should be given until birds are about ready to come into production.

Management and Feeding of Caged Layers

This newer method of managing laying hens—keeping them in individual cages—has created widespread attention, and the increasing number of installations of hen batteries throughout New England is noteworthy.

While the battery system is still in a somewhat experimental stage of development, the favorable results secured by numerous operators have furnished sufficient evidence to justify its recognition as one of the standard methods of management for layers. Due to the rapidity with which laying cages came into use, there was for a time a lack of

well-established information in regard to the behavior, management, and feeding of caged layers, as well as the type of equipment best suited for this purpose. Today with the improved equipment available, with the information secured from observing operators, with the results of studies made by feed manufacturers, and the tests conducted by state agricultural experiment stations, many of the uncertainties and difficulties previously associated with the operation of laying batteries have been removed.

The hen-battery system is a highly intensive method of laying management and is probably best adapted to mass table-egg production. By placing each production unit, that is, each layer in an individual compartment, an effort is made to provide the most desirable and uniform environment so as to obtain a maximum of results in egg yield with a minimum outlay of cost and labor, and a reduction in losses.



Seated: Warren S. Baker, Director of Research, and Coordinator of Experimental Work, Laboratory Control and Feed Production. Standing: Dr. R. O. Brooke, Chemist in Charge, Wirthmore Research Laboratory.

A Summary of Available Evidence

A summary of the experimental evidence now available, together with the observations of practical, efficient operators of hen batteries, appears to indicate the following:

Individual egg yield can be accurately recorded, egg quality noted, and the general behavior and condition of each bird observed.

Egg yield comparable to that from floor birds may be expected from caged layers properly fed and carefully managed.

Egg production is less affected by seasonal weather changes, provided correct feeding and management practices are followed, than with laying-house groups.

Soiled eggs or losses due to the hens eating eggs are not serious problems and can generally be controlled.

As with floor-managed birds, egg breakage varies with strains and with management and feeding factors.

Egg size is not appreciably affected by confinement of layers in batteries.

Feed consumption is about the same as with floor birds.

The nutritive requirements for caged layers are similar to those for floor groups, except for a greater and more exacting need of vitamins and for slightly more fiber.

The use of a properly balanced complete ration such as Wirthmore Battery Ration, together with pellets when required, is considered the most successful method of feeding hens in batteries.

Labor requirements for feeding and watering, and for cleaning the belts and pans are generally considered at least equal or possibly greater than in floor pens furnished with labor-saving equipment.

Fully as much judgment and skill are required in feeding caged layers as in feeding floor birds.

Accurate culling made possible by confining the birds in cages results in less loss from actual mortality.

Effective culling is one of the outstanding advantages of laying batteries since eggs per cage per year rather than eggs per bird are usually the primary objective. This makes possible approximately 100 per cent utilization of equipment, providing replacements are continually made.

Costs attendant to continuous replacements must be considered as a factor of real importance.

Cages are automatic trap-nest devices. As soon as individuals, many of whom would later be a partial or total loss, cease to lay profitably, they can be detected readily and disposed of at market value. In this way a high rate of egg production can be maintained.

The production and livability of layers that are properly nourished and cared for in batteries are dependent largely upon the breeding and condition of health of these layers at the time they were placed in the cages. The close confinement apparently does not affect the birds adversely. However, it should be kept in mind that certain strains of birds seem to be more suitable for use in cages than do others.

Cannibalistic birds or "pick-outs" are entirely eliminated.

The system requires no litter.

At least double the number of birds can be housed on a given area as can be accommodated under the floor-management system.

Initial expense per bird is higher in a cage installation than for floor birds.

Each bird can eat and drink unmolested, thus giving the weaker, more timid birds an opportunity to get the full quantity of food and water.

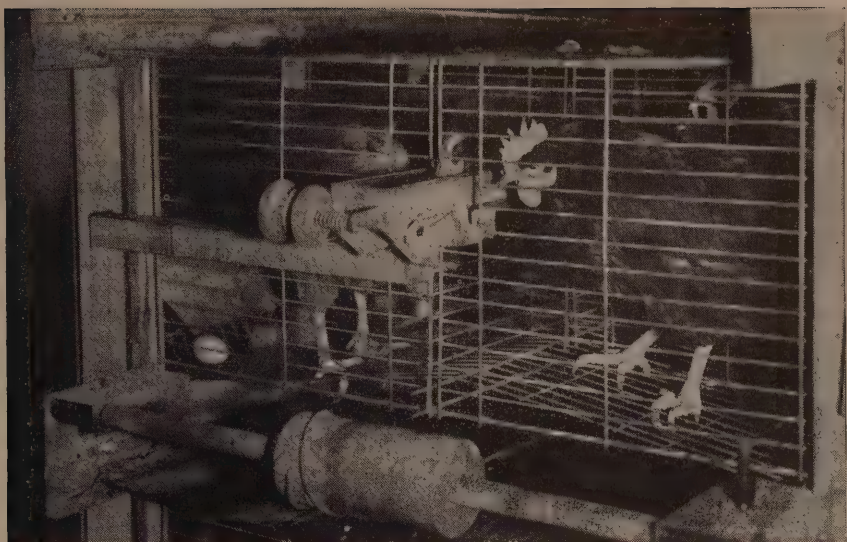
A more careful check can be kept on the feed consumption and performance of individuals in comparison with layers handled in the orthodox manner.

Lice and mites remain a problem.

When the batteries are equipped with nonwasting feeders and when watering troughs or drinking devices are located in the center of the battery, food wastage and water spillage are no longer serious problems.

Selecting the Laying Cage

While laying batteries are comparatively new, some of the more discerning manufacturers have been constantly making improvements and overcoming many of the more serious defects until there are now some well-designed models on the market. Poorly designed, cheaply constructed hen batteries are an unwise investment. In purchasing laying cages, one should be sure they are of sturdy, nonrusting construction, and that equipment includes nonwasting feeders and either dropping belts or pans of lasting composition with durable and easily operated rollers or scrapers.



Water Consumption Is Important. A Plentiful Supply of Fresh Water in Clean Troughs Is Essential.

There are two water systems, the "drip" or "nipple" type, and the cup or trough type. Opinion differs as to which of these systems is the better. Of more importance than the system, however, is the actual location of the waterers themselves. On many of the latest models of laying cages, the waterers are found running lengthwise in the middle of each deck instead of along the front of the cages above the mash hoppers. This is considered by many users as a decided improvement. Less feed is deposited in the water, and there is no spillage of water into the feed troughs. When one is purchasing batteries, all of the above-mentioned items should be carefully noted.

Housing Requirements

Because temperature conditions can be more efficiently controlled in a well-insulated building, the room in which laying cages are to be used



The "Nipple" or "Drip" System of Watering Works Effectively.

should have insulated walls and ceiling. Insulation also helps to overcome some ventilation problems.

A space of about three feet between batteries, and one and one-half feet from the side walls, with a four-foot aisle at one end should be allowed. It is best to provide considerable air space above the tops of the cages. The ceiling height of the hen-battery room should be at least nine or ten feet.

When remodeling a building which has low side walls and a gable roof, the side walls and rafters should be covered with insulating ma-



Two Views of a Modern, Commercial Laying-Cage Plant Designed and Built Especially for Laying-Cage Installation.

terial up to a height of about ten feet, and a ceiling built across at that point. When new construction work is involved, some difference of opinion exists as to whether a one-story building is preferable to a

double-deck or multiple-deck house. The single-deck building is more universally used. It is generally agreed that the building should run from north to south with the cages running crosswise.

Ventilation

Ventilation has two functions to perform in connection with the laying room—to provide fresh air and also to help control temperature. Since so many birds are confined within a certain floor area, it becomes a very important matter.



Interior View of a Modern, Efficient Laying-Cage Plant.

Properly constructed, home-made systems may be used economically. There are several commercially built systems on the market.

Vertical ventilating flues, the bottoms of which are placed flush with the ceiling and the tops of which extend above the roof commonly form the ventilating system. The number of flues depends upon the size and shape of the battery room.

The vertical flues may work without fans but in some locations exhaust fans in the flues are necessary. In rooms that are not too large, one or two flues placed over the center aisle may be all that are required. If the room is large and wide it may be necessary to place these flues so that the openings come above the cages themselves. In this latter case it is advisable to place sheets of building paper or light galvanized iron over the tops of those cages located close to the flues.

Heat

In rooms of moderate size, circulating heaters have proved satisfactory. Satisfying results have been secured when larger areas are to be heated by placing radiators or a series of pipes along the walls on two or three sides of the laying-cage room, using hot water with thermostatic control. Hot-air heating systems with forced air circulation are used with some installations.

Light

From the standpoint of economy, it is desirable to provide enough natural light so that only a minimum of artificial light will need to be used. Therefore, the proper location and size of windows are important.

A single-sash, six-light window should be placed so as to come exactly opposite the aisles between the batteries at a height so that the top is at least one foot higher than the top of the cages. It should be made so that it can drop in at the top, with a guard or shield at the sides, and should be removable. A series of windows located on opposite sides of the room or building affords a good distribution of light and will aid materially in providing proper ventilation.

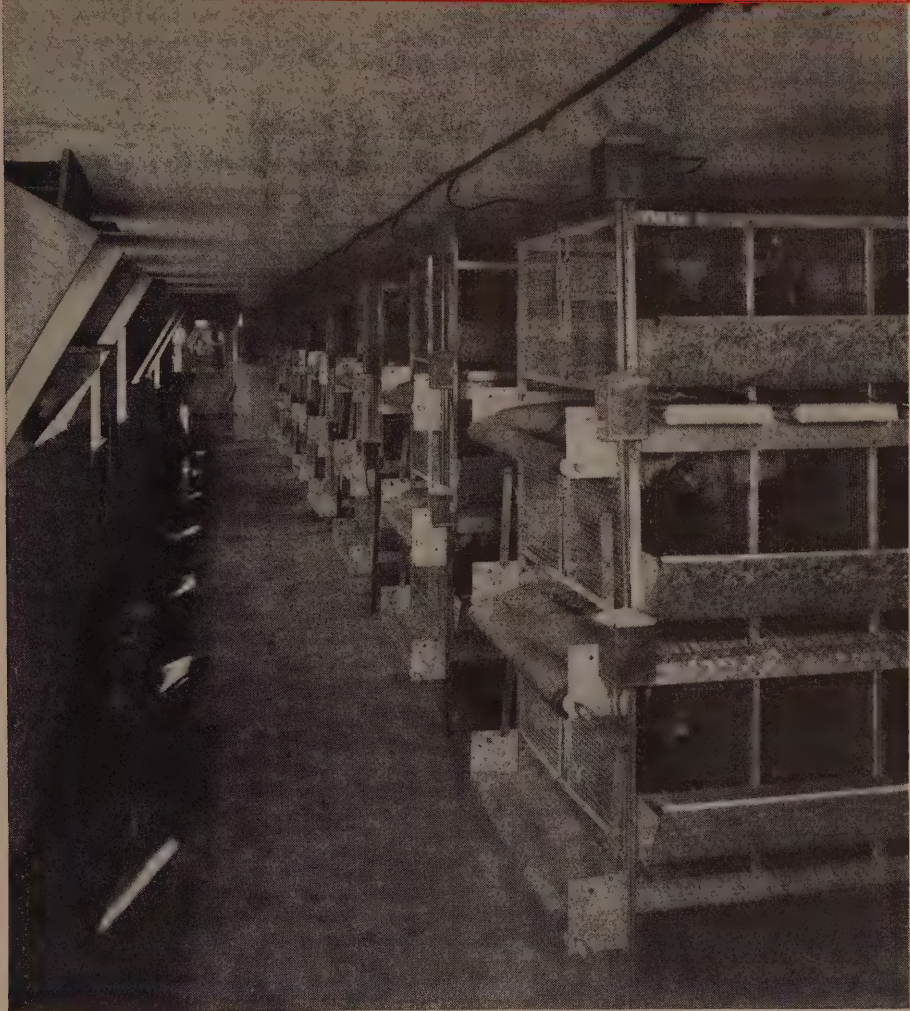
Temperature

Temperature requirements for the successful operation of laying batteries have not been standardized at the time this book is published. Maintaining a room temperature of 45 to 50 degrees during periods when artificial heat is being used is considered best by one group of operators while others contend that most satisfactory results are secured when temperature readings range around 55 degrees. There is some evidence indicating that while higher temperatures may tend to increase egg yield and feed consumption, egg size is reduced and flock health adversely affected.

Holding reasonably low temperatures during hot weather is, of course, a difficult problem under ordinary conditions. Drawing in the outside air during the evening and early morning hours or all night by means of an electric fan placed under a grating in a hole in the floor, or by an exhaust fan in the ventilating flue tends to keep the interior of the battery room cooler during the hotter part of the day.

Handling Caged Layers

Proper management requires frequent handling of the individuals to determine body weight and flesh condition. In order that any birds which need to be removed can be detected and replacements promptly made, it calls, too, for close observance of any deviation from normal



Proper Insulation and a Good Distribution of Light Are Highly Desirable.

appetite that may occur. Salvaging the unprofitable birds while in marketable condition and replacing them with new recruits is a profitable, sound practice as it reduces losses from mortality and helps to hold a more even and a higher average egg yield.

Artificial Lighting

Under normal conditions use artificial lights to give the birds a 12-hour to 13-hour feeding day. To hasten maturing pullets into production, to increase the rate of laying, or to restore production levels following slumps, artificial lights may be used up to a maximum of 15 hours per day. The stimulating effect of brighter lights often produces desired results without extending the lighting period.

Any one of four lighting systems may be used—early morning, evening, morning and evening, or the “night lunch” system which means putting the lights on for an hour any time between 9 P.M. and midnight. All-night lights are seldom advisable.

Planning for Replacement Pullets

The successful operation of laying cages necessitates a continuous supply of ready-to-lay pullets for making prompt replacements of culls, low producers, "broodies," and dead birds. Every empty cage represents loss of eggs and lowered profit per bird.

A monthly replacement of pullets should be planned for at the rate of ten per cent or less of the total number of caged layers. Some operators follow the plan of starting a new lot of baby chicks every month or six weeks, while others find that they can effectively meet their replacement requirements by having three or four broods of chicks a year.

Making Replacements

If conditions permit, it is wise to remove all of the birds from a single row or side of a section of cages and replace them with pullets of the same age or those that have reached a similar degree of maturity. Following such a plan helps to overcome a difficult feeding problem. When replacement pullets are to be placed in vacated cages in a battery already holding some layers that are accustomed to cages, there is a choice of two systems to follow. One group of operators prefers to refill the vacated battery units with pullets just commencing or about to lay, taking them directly from the developing batteries, floor, or



Good Ventilation, Clean Floors,
and Frequent Removal of Drop-
pings All Tend to Maintain
Flock Health and to Keep the
Laying-Cage Room Free from
Foul Odors.

range. Others believe it is best to use a section of individual cages for holding the mature pullets and allow them to remain there until they have been in production for two or three weeks before transferring them to fill the vacancies in the regular laying sections. It is claimed that by following this latter plan there is less tendency even for a temporary drop or delay in egg production.

The hatching date of each individual should be placed on the record sheet, and the record moved with the birds.



An Up-To-Date Commercial Caged-Layer Plant. Capacity Approximately 1,000 Layers.

Culling

Assuming that only healthy, thrifty, promising-looking birds are caged in the beginning, culling will not ordinarily be extremely heavy during the first part of the laying year. As time goes on, every bird that shows unthriftiness should be removed. By the end of the first two months of production the probable rate of lay or intensity of each bird is determined. Those birds which lay less than the number of eggs set as a standard by the operator may be culled. The standard, in order to assure a profitable annual production, must most surely be up to 12 eggs per month.

The extent to which it is safe to practice rigid culling depends considerably upon the type of market for, and prevailing prices of, poultry meat. It is understood that all unhealthy birds should be disposed of promptly.

What length of pause in egg yield at various times justifies the removal of individuals, and whether or not it is profitable to permit birds to go through a partial molt, are questions which deserve careful thought. Such factors as the availability of suitable replacements, and market for fowl, demand consideration before reaching a definite decision. In culling, it must also be remembered that improper feeding, poor housing conditions, irregularities and extremes in room temperature, and frightening of the layers are responsible for temporary slumps

in egg production, and these factors of mismanagement must not be held against the birds when making the decision. The efficiency of the poultryman's management, together with judicious culling, determines the average egg production and, subsequently, the extent of the success of his business.

Dimensions and Capacity of Laying-Cage Units

Listed below are the capacity, width, length, and height of three different makes of laying-cage units. These specifications are given so as to enable any one who is thinking of installing hen batteries to estimate the quantity of floor space required to accommodate a given number of adult birds:

Capacity	Floor Space	Height (Approximate)
48 hens	3' 9" by 9'	
72 "	3' 9" by 13'	70"
96 "	3' 9" by 17'	
120 "	3' 9" by 21'	
48 "	*4' by 9' 10"	
72 "	*4' by 13' 10"	72"
96 "	*4' by 17' 10"	
108 "	*4' by 19' 10"	
48 "	3' 6" by 9' 6"	
72 "	3' 6" by 13' 6"	70"
96 "	3' 6" by 17' 6"	
108 "	3' 6" by 21' 6"	

*Including space taken by the feed troughs

Feeding Caged Layers

The complete-ration system, the scratch-and-mash system, the feeding of pellets exclusively, or certain combinations of these systems can be used for layers in batteries. The system most universally followed, however, and the one which we unqualifiedly recommend is the use of a good complete ration such as Wirthmore Battery Ration, together with pellets when needed. Both Wirthmore Battery Ration and Wirthmore Laying Pellets are designed especially for caged layers.

The nutritive requirements of caged layers are more exacting than those of floor birds. Furthermore, vitamin D is needed in larger quantities. Wirthmore Battery Ration economically supplies the food needs of caged layers in correct proportions. Added feed intake is supplied, when needed, by the feeding of Wirthmore Laying Pellets.

The use of these feeds results in better maintenance of body weight, better health, improved egg-shell texture, pleasing uniformity of yolk color, and a high rate of sustained egg production.

The scratch-and-mash system is not in general use for caged layers.

It involves more labor and far more skill. The use of pellets alone has proved unsatisfactory in the large majority of cases. Likewise, the use of moist mash as a supplement has proved to be a questionable practice and we recommend it only in extreme cases and then by none except experienced feeders. It is extremely easy to overfeed moist mash. This results in accumulation in the trough of old feed which will soon start to mold.

The impression prevails among many experienced operators that fully as much skill and care are required in the feeding of layers in batteries as when the floor method is employed. One of the chief difficulties in feeding caged layers is to meet the requirements for varying amounts of feed for individual birds.



At Feeding Time Each Bird Has an Opportunity to Eat without Interruption.

Skillful feeding includes giving close attention to feed consumption, body weight, and flesh condition of the laying fowl, and this calls for individual observation. Information so gained enables the feeder to make changes promptly in the feeding program. Such a procedure in actual practice requires time and labor, but is very much worth while.

A method of feeding that is found to be very satisfactory is to feed Wirthmore Battery Ration in just about the quantity that will be consumed before the next feeding time. This practice tends to stimulate the appetites of the layers and avoids an accumulation of stale

feed in the hoppers. At times it is advisable to feed mash more than once daily in order to increase feed consumption but this practice should be held in reserve for use only when needed.

When the operator's observations of feed consumption, body weight and flesh condition indicate the need for further feed intake there are two steps in feeding practice to be adopted. First, place small quantities of fresh ration in the hoppers more than once daily. The second and later step is to add to the daily ration a supply of Wirthmore Laying Pellets. The quantity of pellets fed should not exceed four quarts per 100 birds daily (approximately one ounce per bird per day). Either or both of these practices may be discontinued when the need for them no longer exists.

After the young layers have been in production from three to four months, there is a possibility of too severe a decline in production if these practices which result in greater feed intake are not employed. After holding the high level of production for a period, the normal tendency is for body weight to drop off and, shortly afterward, for production to follow in a downward swing. The timely use of the measures described will delay and make less severe the drop in body weight and in number of eggs laid at such periods.

Oyster shells and grit, or limestone grit alone, should be supplied to caged layers. If oyster shells and grit are used, supply one part grit to three parts oyster shells. If a cage is supplied with a hopper for these materials, keep a supply of them in that hopper. Otherwise, sprinkle these materials on the mash twice weekly.



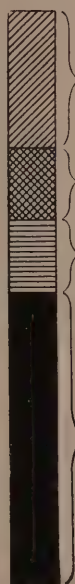
Better

HATCHABILITY

How to Secure It

High average hatchability is of great importance to New England poultrymen who are producing baby chicks or selling hatching eggs. Most hatcheries purchase hatching eggs on a premium basis, paying for better hatchability by means of increased premiums over the regular price. Increased hatchability means decreased cost of producing chicks and that means better profits. The chart below shows graphically an estimated division of the average cost of producing chicks here in New England. Reduction of costs through increased hatchability will benefit alike the producer of hatching eggs, the hatcheryman, and the poultryman who buys chicks.

Cost per 100 chicks can be reduced for the hatcheryman and better chicks secured through better hatchability. Increased premiums may



Other Costs

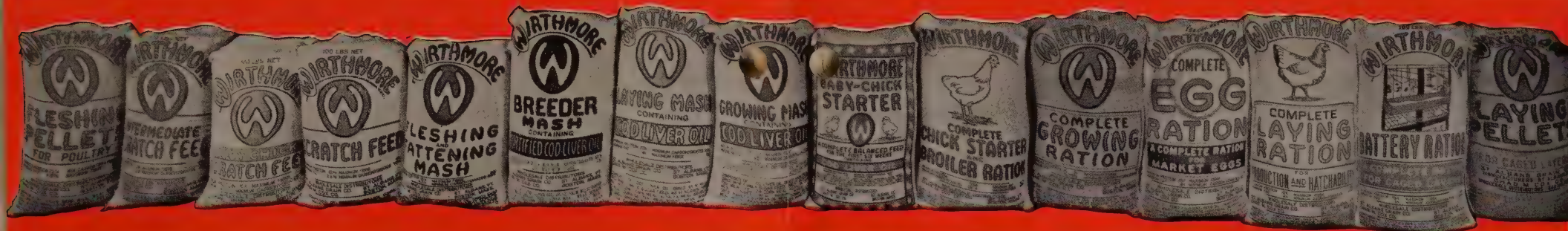
flock improvement, advertising, heat, light, power, boxes and supplies, telephone, telegraph, postage, etc.

Rent, Depreciation, Interest, Insurance, Taxes, Repairs

Labor

Egg Costs

Estimated division of the average cost of producing chicks here in New England.



The Wirthmore Family of Poultry Feeds

The COMPLETE RATION System

Wirthmore Complete Chick Starter and Broiler Ration.
For the entire 9 to 12 weeks of brooding.

Wirthmore Complete Growing Ration.
For the important weeks between brooding and maturity.

Wirthmore Complete Egg Ration.
For production of market eggs exclusively.

Wirthmore Complete Laying Ration.
For production and hatchability!

**Wirthmore Fleshing Pellets — or
Wirthmore Fleshing and Fattening Mash.**
For use whenever added feed intake is indicated and for preparing birds for market.

The SCRATCH-AND-MASH System

Wirthmore Baby Chick Starter.
Fed the first six weeks. A complete starting ration.

Wirthmore Growing Mash.
Fed with scratch grains from the end of sixth week to maturity.

Wirthmore Laying Mash.
The old reliable market-egg producer. Fed with scratch grains.

Wirthmore Breeder Mash.
For production and hatchability. Fed with scratch grains.

**Wirthmore Fleshing Pellets — or
Wirthmore Fleshing and Fattening Mash.**
For use whenever added feed intake is indicated and for preparing birds for market.

For CAGED LAYERS

Wirthmore Battery Ration.
A complete ration that meets the special needs of caged layers.

Wirthmore Laying Pellets.
For use with Wirthmore Battery Ration whenever added feed intake is indicated.

WIRTHMORE POULTRY FEEDS

A New England Quality Product -- made by and for New Englanders

Added Income Secured Through Increased Hatchability When Selling To Hatcheries Paying Premium

Per Cent Hatch	Typical Premium in Cents Per Dozen	Premium Paid Per 1000 Eggs	Gain Per 1000 Eggs Over 60-65% Hatch
60-65	10	\$8.33	0
66-70	12	10.00	\$1.67
71-75	14	11.66	3.33
76-80	16	13.33	5.00
81-85	18	15.00	6.67
86 up	20	16.66	8.33

EXAMPLE: A man who sells even as few as 20,000 hatching eggs to a hatchery paying a premium rate equivalent to that indicated above would, if the eggs hatched at a rate of 71-75%, receive \$66.60 more for the eggs than would be the case if the eggs hatched only at a rate of 60-65%. ($\$3.33 \times 20 = \66.60)

Added Income from Extra Chicks Secured by Increased Hatchability

Per Cent Hatch	Per Cent Gain Over Average Hatch	Increased Returns per 1000 Eggs Set When Chicks Sell At		
		12 cents	14 cents	16 cents
60%	0%	0	0	0
65	5	\$6.00	\$7.00	\$8.00
70	10	12.00	14.00	16.00
75	15	18.00	21.00	24.00
80	20	24.00	28.00	32.00
85	25	30.00	35.00	40.00

EXAMPLE: A man setting 20,000 eggs and selling chicks at 14c each, who is able to increase hatchability from 60% to 80%, would increase his gross returns \$560.00.

be obtained by the flock owner producing hatching eggs, and a longer and more secure market maintained. Today hatcheries purchasing eggs are keeping accurate records of the hatchability secured from the eggs purchased by them, the quality of the chicks resulting from the eggs, and the way in which hatchability is maintained throughout the year. Flock owners who ship eggs that vary widely in their hatchability or run consistently poor in hatchability, thus decreasing the income of the hatchery and reflecting on the quality of the chick which is produced, are soon dropped from the list. High average hatchability is increasingly important to the breeder hatcheryman who produces his own hatching eggs, for he directly benefits from all the added profits of better hatchability. The two charts on preceding page will give a general picture of the added income to be secured by the producer of hatching eggs, the hatcheryman, or the breeder hatcheryman.

Practical methods of increasing hatchability may be divided roughly into four groups:

- | | |
|---------------|---------------|
| 1. Breeding | 3. Incubation |
| 2. Management | 4. Feeding |

Only such methods as are capable of practical application by New England poultrymen are given here.

Breeding For Better Hatchability

Two general methods of breeding for better hatchability are followed by New England poultrymen. First, pedigree breeding and progeny testing which involve trap-nesting and wing-banding of chicks and leg-banding of layers; and a complete system of bookkeeping for tracing and checking progeny of various matings. Probably relatively few poultrymen, because of the expense and time involved in pedigree breeding, will adopt this method of improving hatchability through breeding, yet New England has more pedigree breeders in relation to the number of poultry flocks than any other section in the United States. Second, and the more common method, is that of flock selection plus the purchase of stock from the pedigree breeder. Most poultrymen will follow this system of flock selection and then go to the pedigree breeder for eggs, chicks, or cockerels which come from families which carry high hatchability. This is the least expensive and most practical method for the average poultryman.

Pedigree breeding requires the expenditure of much time and money. Furthermore, a pedigree breeder should have a working knowledge of genetics, be willing to study and keep abreast of the newer developments in the field, be well informed as to the type and general characteristics of the breed, have patience and perseverance, and above all,



Trap-Nesting, Wing-Banding, and Recording.
(Illustrations courtesy of Hubbard Farms, Walpole, N. H.)

love for the work. The value of the work is unquestionable. It is one of the most effective means of producing better hatchability.

Discerning breeders have learned that for best results they cannot rely upon appearance alone. Some of the unseen characteristics that should be known when selecting quality breeding birds are: livability; persistency and intensity of egg production; freedom from broodiness; egg quality and hatchability of the parents and families of the individuals used. All of these characters and many others essential to the success of a poultryman are inherited and can be secured to the fullest measure only through pedigree breeding and progeny testing.

A pedigree breeder who wishes to improve hatchability should follow a program which will enable him to eliminate as breeders all those cocks or hens that persistently do not give high fertility or high hatchability of eggs. A general improvement program would be equivalent to the following:

1. Select hen breeders which as pullets have shown not less than an 85 per cent hatch of fertile eggs.
2. Mate these selected hens to cocks, none of whose previous mates have ever shown less than 60 per cent hatchability. (To insure more rapid progress, cockerels from these matings and from the matings in the following successive steps may be used with the general flock.)
3. Later, only cock breeders should be used that never have a single daughter with a hatchability of less than 60 per cent.
4. Eventually, mate the male breeders only to those old hens who never fall below 85 per cent or better and all of whose daughters equal or exceed 85 per cent hatchability.
5. Mating of hens of the character recommended in No. 1 to cocks such as are recommended in No. 4 should give a minimum hatching record of 85 per cent for all male breeders.

The pedigree breeder works with many characters in addition to that of hatchability, such as outlined above, and he should continually strive through correct knowledge and rigid selection of his matings to maintain these characters while he is improving hatchability.

Poultrymen purchasing stock or eggs from well-established pedigree breeders should be willing to pay and should expect to pay a substantial price for the work, time, and effort that is involved in the production of such a superior quality product.

Eggs or stock that come from pedigreed families which possess desirable characteristics are usually well worth the price asked for them. Considering hatchability alone, here is a concrete example:

With 15 females and one "well-bred" male, at least 900 eggs suitable for incubation could be produced during a four months' hatching period. (This would be only 15 eggs per bird per month, or less than 50 per cent production.) Out of these 900 hatching eggs the poultryman would get 600 chicks, figuring at a rate of only $66\frac{2}{3}$ per cent hatchability. From these 600 chicks the poultryman would

have at least 250 pullets to house. If, when the hatching period came along for these 250 pullets, each of them produced only one extra chick per month, the result would be four extra chicks per bird. Valued even as low as ten cents each, these four extra chicks would make an extra profit of 40 cents per bird, or in other words, \$100 increased income for the flock.

It is obvious from the above that an investment in "well-bred" stock should yield handsome returns.

Flock Selection

Flock selection plus the use of pedigree stock is the more common and less expensive method of improving hatchability. This will involve rigid selection of birds for vigor and freedom from disease, and selection of eggs for size and quality, together with selection for rapid feathering, moderately early maturity, good body size, breed type, and freedom from disqualifications. Then it is necessary to secure from the pedigree breeder, eggs, chicks, or cockerels that come from families carrying the character of high hatchability. If possible, some measure of the stock's ability to transmit hatchability should be known, and



These Breeding Cockerels Show CONDITION.

the result of the mating of this stock should be carefully watched if the stock was secured from other than the original foundation breeder. Sometimes undesirable characters are amplified when new stock is brought in so that it is highly important that the results of the mating be carefully watched for undesirable characteristics such as low production, winter pause, broodiness, too early or too late maturity, poor type, poor egg quality, and lowered or unimproved hatchability. Where possible, one should return for his pedigreed stock to the breeder from whom he originally purchased his stock. This should, generally speaking, make for a better "nick" in the characters which are desired.



Selecting Hens for the Breeding Pens.

The males secured direct from the pedigree breeder or from the eggs or chicks purchased from him are very important. They should be carefully selected, and the following physical characteristics closely observed:

Broad deep head, short well-curved beak.

Full face with prominent clear bright eyes.

Head parts of deep red color.

Rather short, arched neck.

Straight, medium-length, sturdy legs set squarely underneath body and wide apart.

Broad shoulders and good depth from center of back to center of keel.

Back wide and flat over hips and of good length.

Well-spread, barrel-shaped ribs.

Due regard should be given to rapid feathering, moderately early maturity, good body size, breed type, color, and freedom from disqualifications.

Wherever possible, it is highly recommended that eggs rather than mature stock or cockerels be purchased from the pedigree breeder. This will serve not only as a precaution against introducing disease onto the home farm, but will enable the purchaser to check the hatchability of the eggs and watch the stock grow, comparing its many qualities with the home stock. Many slight differences or peculiarities will be lost in the crossing, but if undesirable, one should be ever alert to see that they do not develop in the offspring.

The selection of female breeders to be mated to pedigree stock should be on the same basis as that for breeding males. Close relationship exists between rate of maturity and body size for breed or strain. Where one wishes to reduce the cost of introducing pedigree stock to the minimum, males from the purchased stock may be used to head a rather small pen of carefully selected female breeders on the home plant, and the result of this mating carefully noted. If the females prove satisfactory, the male offspring of this mating may be used to head all of the pens on the home plant. Thus, one may spread the qualities of a few good breeding males over a large number of birds and purchase a relatively small quantity of pedigree stock each year.

Points to Keep in Mind

1. Close inbreeding of birds without selection for hatchability will materially lower it.
2. Hatchability may be maintained in inbred families by selection.
3. Outcrossing may increase hatchability if the hatchability in strains to be crossed is low; if high (80 per cent) it may or may not increase hatchability.
4. Breeding for improvement in interior quality (heavy albumen) of eggs should directly improve hatchability.
5. Breeding for shell quality (texture) should have a tendency to improve hatchability.
6. Breeding for good egg shape, although important for commercial reasons, is apparently not important to hatchability, except that some poultrymen experience difficulty in hatching long narrow eggs.
7. Breeding for extremely large egg size will have a tendency to reduce hatchability.
8. Depending on the age of both, breeding from yearling or older males and females will usually materially lower hatchability of the resulting eggs from this mating. However, this practice will not lower hatchability of future generations.
9. Breeding from old hens and old males will increase longevity in the offspring and serve to build disease resistance, which will tend to raise hatchability.
10. It is easier to raise the level of low-hatching families than relatively high-hatching families.

Artificial Insemination

Some progress has been made with artificial insemination, which is the process of securing semen from male birds, and with it fertilizing the female birds by other than natural means. Work along this line has been done at the United States Department of Agriculture Experiment Station at Beltsville, Maryland, as well as by a few individual poultrymen, some of whom operate laying-cage installations. What the ultimate practical application of this method will prove to be cannot be stated with certainty at the time this book goes to press.

Improving Hatchability Through Management

BROODING AND REARING the breeding birds is an important part in getting better hatchability.



The Colony System of Brooding Is Excellent for the Future Breeders.

Breeders that are well grown will not present as serious management problems as will birds that have been diseased, ill fed, or poorly managed during the growing period. Well-grown birds will maintain condition much better in the laying house. Many flocks of birds which have been poorly grown, have been ravaged by coccidiosis and paralysis, and poorly fed during the growing period never produce good hatchable eggs, even under the most ideal conditions of management, feeding, and incubation. Future breeders should be allowed to grow normally and naturally. Forcing methods such as all-night feeding of chicks, close confinement for too long a period through the brooding season or on the range should be avoided.



This Range Provides Ideal Conditions for Growing the Future Breeders.

Where poultrymen are growing two breeds or strains of birds on the same farm, it is highly advisable that they be brooded in separate brooder houses and segregated on separate ranges. Where this is practiced, both strains or breeds will be brought into the house in better condition.

Building and maintaining physical condition of the breeders is highly important. If the physical condition of the breeders is good at housing time, it will be relatively easy to maintain it during the breeding year. It is of little avail to build hatchability through breeding unless the physical condition of the breeding flock is maintained to a high degree in order that the inherited characters may have an opportunity to assert themselves.

The breeders should be free from disease and should maintain correct body weight. These factors are absolutely essential in order to keep maximum hatchability.

Condition is well within the control of the poultryman and is traceable to:

- Quality of original breeding stock.
- Quality of hatching eggs placed in the incubator.
- Incubator management.
- Care and feeding of chicks through the brooding period.
- Handling and feeding of growing stock.
- Proper development and freedom from disease.
- Selection of quality males and females.
- Correct housing conditions.
- Feeding and management of breeders.

All the above factors contribute to the *physical condition* of the breeding stock at the time hatching eggs are produced.

Selection and Handling

Selection and handling of young and old female breeders for the breeding pen, as well as young and old male breeders, is an important consideration.

Not only for Market
Birds, but also for the
Breeding Flock, CON-
DITION is All-Important.



Young female breeders should be carefully selected for the breeding pen. Hold to a high-quality standard, choosing only healthy, good-sized, well-formed individuals.

Reject any poor-type, undersized, thin-fleshed, weak, sickly appearing birds. Handle the birds gently and carefully, avoid frightening or chasing them when moving them to their new quarters. If possible, house at night and place the birds directly on the roosts in the breeding pen. House those birds that are nearing or have arrived at sexual maturity before or at the time the first few eggs are laid. Housing early avoids many management problems, makes the birds less excitable at laying time, helps to avoid prolapse and cannibalism, and allows female breeders to better condition themselves. By housing at several intervals, those females that have reached sexual maturity together are housed together. This helps to overcome "bossism" and builds a higher average feed intake. Examine each bird for flesh condition so as to note the general body weight of flock. Do not crowd birds in laying quarters, and be sure to allow ample space for males. A good practice is to allow a little more room for breeders than for regular flocks producing market eggs.

If females are to be mated soon after housing, it is recommended that they be mated on range before the pullets are housed. This will enable them to become accustomed to the cockerels and will avoid excessive frightening of the new birds in the laying house, which causes serious



Pullets and Males on Range.

troubles such as ruptured egg yolks, prolapse and cannibalism. It also helps to prevent cockerels from driving pullets onto the roosts where they will get out of condition. General hatchability will not be good until pullets have reached 50 per cent production.

Old female breeders of one year or more should be thoroughly conditioned before entering the breeding pens for another year. If permitted, many yearling females which have been bred for persistent production will continue to lay too late into the fall months to be of value as early breeders. It is often wise to force the molt of these adult females at the end of their first laying year for the following reasons:

1. To stop their laying before they become depleted and have exhausted much of their reserve strength.
2. To improve hatchability by giving them a rest period and prevent the high-producing individuals from laying and molting at the same time.
3. To allow these qualified breeders to molt, grow feathers, regain stamina, and recuperate fully and quickly.
4. To get earlier hatching eggs and more of them during the breeding season.

The earlier hatched birds are most desirable for this purpose as they have completed their first laying year by August or September. They then have sufficient time to molt, return to fine physical condition, and get back to laying by late fall or early winter.

The best plan is to move these females to colony brooder houses, barracks houses, summer laying shelters, or regular range shelters. If possible, provide a well-sodded range. The use of a clean yard is much better than confinement. Withhold all mash of any kind for one or

two weeks and feed scratch grain sparingly. Some restrict the water supply for a few days. At times it is necessary to feed only oats or barley in order to stop production. After production has ceased, return to full feeding program.

A complete laying ration is considered by many to be the most desirable during the molting period as the birds are assured a well-balanced diet. It also tends to overcome the danger of these older birds becoming excessively fat due to overeating scratch grain, particularly corn.

Yearling breeders that have finished their first production year and are ready to molt should be transferred to the range as early in the fall as possible and permitted to remain there for six or more weeks, depending upon weather conditions. If well managed, these birds on completing their molt will demonstrate improved breeding ability. The extra work and effort involved in handling them in this manner is a worth-while practice. Hens selected from such flocks for the breeding pens should, of course, be in prime condition, healthy, and vigorous. Only the best individuals should be kept over from year to year.



Yearlings Being Reconditioned. Small or Large Laying Shelters Can Be Used.

Young breeding males should be first segregated and handled at broiler age. A minimum of 12 should be selected at this age for each 100 birds that it is desired to mate in the breeding pen. It is highly desirable that twice this number be selected, if possible, and then gradually reduced by selection during the growing season. Continually select the more aggressive, vigorous birds, culling the slow-growing, slow-feathering, poorly developed, thin or weak individuals.

Keep birds of different ages separated to insure maximum growth and to lessen danger of the larger and older birds killing the younger ones. An occasional old cock among the young cockerels will help to prevent excessive fighting. If possible, provide twice as much feeding space as for young female breeders, and spread both the hoppers and water

dishes to all parts of the range, thus avoiding much fighting, and insuring more uniformity of growth among the males.

Young cockerels need an abundance of room. They become restless, active, and scrappy as they reach maturity. More roosting space is desirable than is the case with young female breeders. Small clumps of bushes on range, rows of corn or sunflowers, piles of brush, or what is known as a "grand stand," will help to avoid excessive fighting among the cockerels.



Young Breeding Males Grown under Ideal Conditions. Note the "Grand Stand" in Rear Center of Top Picture.

It is best not to grow too many males in a single flock. They should be divided into rather small units.

Satisfactory breeding males must have strength and an abundance of constitutional vigor at maturity. Much of it is traceable to the way they have been reared during the growing period.

Young cockerels that have had serious coccidial infection during the growing period will give only fair to poor hatchability regardless of breeding.

Range sanitation is an important factor in growing good healthy cockerels. Culling should be done regularly throughout the growing season so as to remove the weak and undesirable birds while they still have a

market value. This will also prevent them from being beaten and possibly killed by the strong, vigorous members of the flock.

Young male birds of the American breeds should not be mated until they weigh approximately seven pounds. Seven months and seven pounds seems to be a common rule. Young males of the Mediterranean breeds should weigh at least five pounds.

Young males mated before reaching maturity usually make very unsatisfactory breeders. Cockerels younger than six months of age can rarely be depended upon to produce satisfactory results over an extended breeding period.

Old breeding males should be segregated from the females at the end of the breeding season and be given a rest of 10 to 12 weeks to molt and recondition themselves before starting another breeding season. Feed old males well to regain flesh and full body weight and to build up reserve strength and vigor. Provide plenty of water, particularly in warm weather.



Old Breeding Males Being Reconditioned.

An outdoor run or yard is preferable to complete confinement, and free range is still better, if weather conditions permit.

Spreading the old males among the young cockerels on range helps to prevent fighting in the young cockerels and creates a good environment in which to condition the old birds.

Safety roosts or "grand stands" act as an aid in preventing losses from fighting. Build the roosts of poles or two-by-four lumber placed flat on supports about two and one-half or three feet above the ground. "Grand stands" are A-shaped and made of similar material.

Old male breeders that have given unsatisfactory results as cockerels should not be carried over for another season's use.

The number of cockerels per hundred females should be seven to nine, depending on the strain. In the light breeds five to seven are sufficient.

The ratio of old males to old females should be nine or ten per hundred for the heavy breeds and seven or eight per hundred for the light breeds. This is a general rule and should be governed somewhat by the activity of the birds.

Mate birds at least two weeks before saving hatching eggs.

All Breeding Males in the breeding pens should be handled frequently to check general physical condition and body weight.

The physical condition of each male bird affects the fertility and hatchability of all the eggs laid by the females with which he mates. The male is at least 50 per cent of the flock, and his value cannot be overestimated.

Males going into the breeding pen underweight or out of condition may produce good fertility and hatchability for a time, but where cold and unfavorable weather conditions occur, the majority of these males will soon go to pieces.

One out-of-condition or inactive male in flock matings may reduce the fertility and hatchability as much as five or ten per cent.

Rotating the breeding males where flock mating is practiced keeps them in fine physical condition. One extra group of breeding males for each four to six breeding pens allows each group of males a rest of one week every four to six weeks.

Poultrymen expecting to sell hatching eggs during the summer months frequently find it advisable to hatch out enough chickens in the fall to give them by June 1 a sufficient supply of November or December-hatched cockerels to replace those with lowered breeding efficiency or those that are out of condition in the breeding pens.

It is seldom advisable to introduce a new or strange male into a mated pen. Due to chasing and fighting, the other male members of the flock will allow him little or no chance to mate.

Make allowance for at least one extra male per hundred females when pens are mated. If male birds have been properly reared and are properly managed in the breeding pens, undue reduction in numbers of male birds may be avoided.

Male birds should be added to the breeding pen at least two weeks before eggs are saved for hatching. The maximum fertility and hatchability are seldom reached before this time. Allow a little more time for old birds.

Eggs will remain fertile for at least a week after removal of male birds from the flock. Eggs from some females may be fertile up to 19 or more days after males are removed from the pen. When one male or a set of males is removed, and another male or set of males put in the pen, the sperm from the second group will be responsible for almost all of the fertility by the end of the tenth day of mating.

Note: This latter point may be important at times to the pedigree breeder when it is necessary for him to change males. It may likewise be important for breeders of crosses that do not show color distinction. The breeder of crossbreeds using breeds which result in color distinctions may at times wonder about this point, but it is obvious that he may remove one set of males and introduce another set and still continue to hatch. The chicks from the different sets of parents may be separated as they come from the incubator, simply by separating the different-colored chicks.

Four Ways of Securing New Breeding Males

New breeding males may be secured in at least four ways—by the purchase of hatching eggs, baby chicks, males at broiler age, or mature cockerels.

Buying hatching eggs or baby chicks from pullorum-clean, well-bred and disease-free stock is the surest way to avoid the possibility of bringing in disease.

There is danger of introducing disease when cockerels at broiler age or older are brought onto a poultry farm.

Bringing new blood into the breeding flock through the purchase of mature males is a most hazardous procedure because of the danger of introducing disease. Although from appearances there may be no symptoms or evidences of disease, the birds may be carriers of or recently exposed to contagious ailments such as chicken pox, bronchitis, or infectious coryza. Numerous poultrymen have had unfortunate experiences when mature males were brought to their plant from outside sources—these males contracted a form of coccidia to which they had not previously been immunized. Oftentimes the cockerels “go to pieces” quickly.

Be sure to purchase eggs or chicks from a breeder who is pullorum clean according to New England standards and preferably one who has been clean for two or three years. This is excellent insurance.

If stock started or matured is purchased, be sure to inquire about colds, chicken pox, bronchitis, or infectious coryza. Even though birds appear perfectly healthy at the time of purchase, they may be carriers.

Be careful of crates in which new stock is transported. Old crates may be the source of much trouble.

Blood Testing for Pullorum Disease

Blood testing for pullorum disease is one of the first requirements for quality chicks or hatching eggs here in New England. Most hatcheries purchasing hatching eggs require that the producer be on the pullorum-clean list in the state in which he resides. Application for birds to be tested should be made to the state college or state department of agriculture in your state. Some states are testing birds the year round;



The first step in pullorum eradication. Taking the samples and banding the birds.
The numbers on the band and on the bottle containing the sample are alike.

other states test only in the fall months. One should be careful to inquire about testing well in advance of the desired test. At least two and preferably three people should be available to aid the tester sent out from the state. In New England the agglutination or tube test is used and has been highly successful in reducing to almost nothing the percentage of reactors in New England flocks. Samples of blood,



Making and reading the agglutination test. Note the equipment required. Samples are kept in the refrigerator until the test is completed.
(Illustrations courtesy of The College of Agriculture, Orono, Maine)

usually from the wing, are taken at the farm; bottled; marked with the leg-band number of the bird, which is applied at the time the test is taken; and sent to the laboratory where the samples are tested and read, and the results of the test reported to the flock owner. The cost of the test per bird varies with the state. Some states are now absorbing part of the cost of testing the birds.

Housing Conditions

Housing conditions may have considerable effect upon the hatchability of the birds. Adequate housing contributes largely to increased hatches and should not be overlooked or neglected.

Comfortable houses and good living conditions are a tremendous aid in maintaining health of the breeders, sustaining heavy egg yield, promoting fertility, and producing high hatchability.

Poorly ventilated, drafty pens tend to cause wide variation in food intake, resulting in fluctuation of egg production and hatchability.

It has been reported that cold affects the metabolism of the fowl and has a depressing effect upon hatchability; therefore, higher average hatchability may be maintained by adequate housing.

Cold houses often result in frozen combs, reduced activity of the males, lowered fertility, and a temporary slump in egg production.

Extremes in temperature, either summer or winter, affect the breeders adversely and should be avoided through good housing conditions.

Unsanitary conditions have a tendency to endanger flock health and sap the strength and vitality of the breeding birds.

Insulated pens equipped with sliding windows or curtained fronts,



Good Housing Is Important to Hatchability.

properly arranged ventilating systems, nonwaste waterers, and well-constructed floors will better insure dry, comfortable housing quarters for the breeding flock.

Ample hopper space is essential for best results in securing hatchability. Err on the side of too many hoppers rather than not enough.

Do not overcrowd, as it will result in greatly reducing the efficiency of the breeding flock through lowered health, production, fertility, and hatchability. Allow at least four square feet of floor space per bird for birds of the American breeds and three square feet for those of the Mediterranean breeds.

Lights may be used in the laying house to maintain a larger food intake and proper body weight. The proper use of lights will not adversely affect hatchability. Do not exceed a 13-hour day.

For old-hen breeders lights may be turned on after the old birds have had an eight-week period of molt.

The method of using lights is to be governed by the poultryman's preference. Use lights to the best advantage whenever they are needed. For further details refer to the chapter, "The Laying Flock—Management and Feeding."

For Better Hatchability — Check These Details

Maintaining or improving hatchability through management calls for constant attention and checking of details by the poultryman.

Breeders must be kept in good condition.

Houses must be kept dry and comfortable.

Unthrifty or diseased birds should be removed immediately.

Provide an extra group of breeding males for each four to six breeding pens and alternate them so that each group receives a rest.

Provide sunlight through the medium of natural light, open-front pens, wire sun porches, gravel runs or clean yards that are kept sodded.

Use Wirthmore Breeder Mash or Wirthmore Complete Laying Ration throughout the entire laying year.

Feed Wirthmore Fleshing Pellets when necessary to improve and maintain body weight. Avoid excessive scratch-grain feeding.

Keep either granite grit and oyster shells or limestone grit alone before the breeders at all times.

Keep birds free from lice and mites.

Keep broodiness under control. It reduces hatchability.

Cannibalism has a depressing effect upon hatchability.

Do not set or sell eggs when birds are molting or slumped in production.

In pens where production is very poor, separate the better producers from the poorer ones. Place molters or out-of-condition birds together and do not mate them until they are in good condition and are back to 50% production.



Rapid Candling and Mechanical Grading of Eggs Aid in the Production of High Quality Hatching Eggs.

A decrease of five per cent in hatchability is a warning that something may be wrong.

When hatchability falls below 70 per cent, all factors bearing on hatchability should be checked.

An abnormal number of poor-quality or "pot-bellied" chicks predicts a drop in hatchability in subsequent hatches.

Overfat hens, as well as excessively thin ones, lower hatchability.

Higher hatchability produces better chicks with less chick mortality.

Try to keep production at or above 50 per cent.

Be sure males and females are mature and healthy.

Avoid too many or too few cockerels.

Provide wire barriers in pens where there is excessive fighting and interference with mating.

Do not use big clumsy males with active flighty females.

Regulate windows and watch pen temperature to avoid frozen combs and wattles.

Be sure to maintain body weight on both male and female breeders.

Select and care for hatching eggs very carefully. Refer to the chapter, "Eggs, More Quality—Greater Demand."



Note Size and Uniformity of These Hatching Eggs.
(Illustration courtesy of Hubbard Farms, Walpole, N. H.)

Good hatching eggs, as well as good market eggs, depend upon frequent collection, rapid cooling, good candling, grading, storage, and packing.

Where mechanical graders are used, selection of eggs must be made at candling time, and the eggs that are not to be used for hatching graded later for market.

Candling is fully as important for hatching eggs as for market eggs.

Select eggs that do not have thin shells, watery whites, large air cells, blind checks, blood or meat spots.

Medium-sized eggs hatch better than extremely large or small ones.

Do not select eggs which weigh over 30 ounces per dozen. Best results are usually secured when egg weight limit is not greater than 28 ounces per dozen.

Select eggs that are clean. Avoid dirty or washed eggs.

Holding hatching eggs over seven days will lower hatchability.

Turning eggs that are not kept over seven days does not seem to benefit hatchability.

Pack hatching eggs as you would good market eggs, except cases should be lined with paper during severe weather if they are to be shipped.

Improving Hatchability Through Incubation

Incubators to be used should be a matter of choice. Today there are many reliable makes of incubators on the market. Manufacturers of these machines have devoted much time and study to their development and to working out the most satisfactory methods of operation. The hatcheryman can do no better than, first, to make doubly certain that the machine he purchases is one of the modern, efficient, standard makes; and, second, to follow explicitly the directions which the manufacturer supplies him for the operation of that particular machine.

If a reliable make of incubator is used and operated in a suitable incubator room, the hatching operation is within the control of the operator. It should be remembered, however, that the hatch can be lowered by poor operation of the machine.



Incubators at One of New England's Largest Hatcheries.
(Illustration courtesy Hall Bros. Hatchery, Inc., Wallingford, Conn.)

Incubator Room

Incubator room should be of ample size to permit work to be done easily and to provide for necessary equipment and plentiful air space. It should be properly constructed and insulated in order that inside temperature can be controlled.

It should have a ceiling of sufficient height to permit free circulation of air.

It should have a well-constructed floor which can be easily washed.

It should be equipped with facilities to insure correct ventilation.

It should be furnished with auxiliary heating equipment for use when needed.

Incubator room temperature should be maintained at 70 degrees.

It should be entirely isolated from brooding and other operations involving live birds.

A warm room at hatching time will avoid chilling of the chicks.

Wide variations in the temperature of the room should be avoided.

Avoid a dry dusty room for incubation, as chick fluff and dust accumulate, causing a disease problem.

With older types of machines, humidity in the room is absolutely necessary and may be built up by wetting floors, walls, etc.



The basement of this modern building houses some of the incubators at one of the large New England hatcheries. Upstairs is the general office.
(Illustration courtesy Hall Bros. Hatchery, Inc., Wallingford, Conn.)

Incubator Operation

Incubator operation with the modern machines is a much simplified process and has many advantages over the old hand-operated, oil-heated type of machine. Humidity and temperature are controlled with only minor adjustments necessary from time to time. All eggs are usually turned by the operation of a single lever, and hatching is usually done in a compartment separate from incubation. Eggs are transferred from the incubating trays to hatching trays on the 18th day. Separate hatching affords better control of temperature and humidity and far superior sanitation. Hatching trays and equipment are usually removable, and the compartments and equipment can be thoroughly cleaned.

Important Points

Eggs should be prewarmed before entering incubator.

Eggs should be turned at regular intervals through the day and night and never in the same direction.

Eggs should not be turned after the 18th day.

Eggs that are set on end should always have large end up.

Eggs should lie flat after the 18th day.

High temperature weakens the embryo.

Low temperature retards development of the embryo.

There are two critical periods of embryonic mortality—the first during the third and fourth day; the second and most important during the 18th and 19th day.

Poor eggs will not hatch even under ideal incubation conditions.

High carbon dioxide content of the air will smother the developing embryos. Provide adequate ventilation.

Chicks from eggs that have been held in storage over a long period will hatch later.

High temperature at hatching time will cause high chick mortality.

Slow-hatching chicks usually mean low vitality, high chick loss, and larger percentage of culls.

Variations in temperature of only a few degrees may cause high embryonic mortality.

If incubator adjustments are made, observations on development of the embryo should be the basis of correction.

Incubator Sanitation

Incubator sanitation should be given careful consideration, and both incubator and incubator room should be kept in a strictly sanitary manner.

Sick birds should be kept out of the incubator room, and incubator refuse such as egg shells, dead-in-the-shell chicks, incubator fluff, etc. should be removed at once.

When sweeping, keep the floor damp in the incubator room to prevent dust.

The incubator should be thoroughly disinfected after every hatch according to directions of the manufacturer. Fluff and dust should be removed and trays thoroughly scrubbed. In this connection a vacuum cleaner and wire brush are very helpful.

Using sheets of paper or cloth on the bottom of the hatching trays will save much labor in cleaning. They should be removed and burned following the hatching.

Following the thorough dry and wet cleaning, the machine should be sprayed with a good disinfectant, and if of the new cabinet type, fumigated. Follow a similar cleaning program after every hatch.

Improving Hatchability Through Feeding

Today the industry generally recognizes the influence of diet on hatchability. Improper diet is a primary cause of much of the poor hatchability that in the past has cost poultrymen many millions of dollars. Experimental and research work throughout the country has led the way to a newer knowledge of nutrition that no longer makes it necessary for the poultryman to suffer these severe losses.



Feeding Time for the Breeders.

The modern hen is a much more efficient producer of both eggs and meat than her ancestors, thanks to our leadership in the field of poultry breeding, but this same breeding has brought a tremendous strain upon the reproductive metabolism of this modern bird. She requires a much greater store of essential nutrients than her ancestors. Inherited rapid growth gives her a much shorter time in which to store



High-Quality Chicks.

J. C. Allen & Son, West Lafayette, Ind.

away reserves of these essential nutrients necessary to provide for heavy production of quality eggs. Much greater reserves must be built up and preserved where the eggs produced are to be used for hatching. If maximum results in high hatchability and excellent-quality chicks are to be obtained, the diet of the modern breeding hen must be amply provided for from the time she is a chick on through her growing and breeding season.

In many cases where poor starting and growing rations have been fed prior to the breeding season, it has taken two or three months for the breeders to build up suitable reserves on a good breeder ration before high hatchability was secured.

A good breeder ration such as Wirthmore Complete Laying Ration or Wirthmore Breeder Mash is rich in all of the nutrients essential to high hatchability and should be used following the growing period by those who wish to get maximum hatchability of high-quality chicks from the modern hen.

Important factors to consider in the diet of the modern breeding hen should be:

1. The source, variety, palatability, and the methods of processing the ingredients in the ration; the proper quantities of proteins, carbohydrates, fats, fiber, etc., and the method of manufacture.
2. Adequate margin of safety—the required vitamins, the correct source, quantities, and balance of minerals; and the availability of all the required nutrients.

Research and experimental work points out the following important facts in relation to diet and hatchability:

1. High sustained production on an adequate ration will not lower hatchability.
2. Proteins, both animal and vegetable, vary widely in value for the breeder ration, depending upon source and method of manufacture.
3. All vitamins are necessary in the diet of a breeding hen and in quantities in excess of those needed for market-egg production.
4. Within certain limits vitamin A increases hatchability in proportion to the quantities included in the diet.
5. Larger quantities of vitamin A are found in the yolks of eggs of high hatchability than in eggs of low hatchability.
6. Proper quantity of vitamin D is necessary in the diet to insure hatchability, more than that necessary for market-egg production.
7. Low vitamin D content in the breeder ration may be reflected in improper calcium and phosphorus intake by the developing embryo, thus causing poor hatchability.
8. Overdose of vitamin D in the diet will definitely retard hatchability.
9. Correct mineral balance must be maintained in the diet to insure high hatchability.

10. Low calcium content in the diet will cause lower hatchability and lower ash content of the chick embryo.
11. Increase in flavin (that factor formerly called vitamin G) in the diet increases hatchability up to a certain level, beyond which an excess of flavin will not increase hatchability.
12. The quantity of flavin needed for hatchability is greater than for egg production and growth.
13. Vitamin E is necessary for hatchability and must be included in the diet of breeders.
14. Breeders on an improper diet may produce poor-quality chicks with little or no reserve of vitamins and other nutrients, thus resulting in poor growth and high mortality.

The effectiveness of applying these facts to rations soundly designed in long-established nutritive principles is seen in the hatchability records made with Wirthmore Breeder Mash and Wirthmore Complete Laying Ration.

By incorporating abundant quantities of fortified cod liver oil, both Wirthmore Complete Laying Ration and Wirthmore Breeder Mash supply all the vitamin D required for the most severe conditions of housing, laying, and weather. In addition to the antirachitic vitamin, this fortified oil adds vitamin A which in combination with the carotene or vegetable vitamin A in the ration prevents the possibility of a shortage of this hatchability essential.

In the germ of wheat, nature put her richest store of the fertility vitamin E, exceeding even the quantity found in tender green leaves. Liberal quantities of wheat germ and dehydrated alfalfa meal insure highest fertility for Wirthmore-fed breeding flocks. Today's best method of curing alfalfa preserves not only its carotene content, but also flavin. In Wirthmore Complete Laying Ration and Wirthmore Breeder Mash is used dehydrated alfalfa meal which because of the advantages of artificial drying is much richer in vitamin A than alfalfa which is sun-cured. This same type of alfalfa has at least half and frequently almost as much flavin as is found in dried skim milk. Liberal quantities of that element so necessary to normal embryonic growth, flavin, are most economically secured from several sources. Dried whey, dried skim milk, vacuum-rendered white fish meal, dehydrated alfalfa meal, selected meat scraps, and soybean oil meal all contribute substantial quantities.

In addition, the use of dried liver meal, a product which is several times richer than milk in flavin and vitamin G, assures an abundance of this hatchability factor in those Wirthmore rations recommended for the breeding flock.

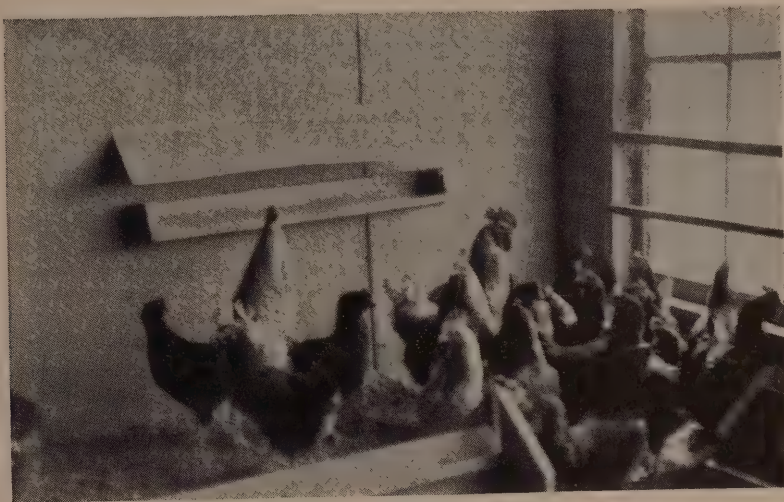
Emphasis on vitamins in the program of hatchability does not detract from the importance of the proper provision of proteins, carbohydrates, fats, and minerals. The ration obviously must provide these essentials,

but the fact is that feed mixtures perfected in these respects will invariably result in reproductive failure unless certain vitamins are present in sufficient quantities.

Years of experience, continuous research and laboratory control give Wirthmore rations properly rounded value in all nutritive requirements.

Feeding Practices That Aid High Hatchability

1. Grow birds normally. Move hoppers frequently, and where green range is available, allow hoppers to become empty daily to encourage exercise and to aid sanitation.
2. Do not force pullets into early maturity by lighting, or by excessive feeding of protein or wet mash.
3. Provide plenty of feed-hopper space, preferably low feeders, in the breeding pen.



Note the High Feeders from which the Cockerels Are Eating.

4. Place small feeders on the roosts for timid males and females.
5. Provide high feeders out of the reach of females for cockerels.
6. Change from growing ration to breeder mash when the birds have reached ten per cent production.
7. Do not use forcing methods for production on the breeders, such as excessive wet mashing, high-protein feeding without proper balance, or excessive lighting.
8. Measure or weigh all feeds daily.
9. If scratch-and-mash system is followed, keep mash and scratch in balance, never exceeding a 60-40 ratio.
10. Use Wirthmore Fleshing and Fattening Mash or Wirthmore Fleshing Pellets instead of heavy scratch-grain feeding to maintain body weight.
11. Maintain a high total feed intake daily.
12. Continually check production and body weight against feed intake.

THE EXTRA VALUE IN A TON OF FEED RELATED TO GAINS IN PER CENT OF HATCHABILITY

When Selling 10,000 Hatching Eggs At Typical Premium Scale			
Per Cent Hatch	Rate of Premium	Extra Value Per Ton of Feed Resulting From Hatchability Premiums	
		Wirthmore Complete Laying Ration	Wirthmore Breeder Mash
60-65	10c	\$ 9.46	\$ 9.43
66-70	12	11.34	11.32
71-75	14	13.22	13.21
76-80	16	15.10	15.10
81-85	18	16.98	16.99
85+	20	18.86	18.88

NOTE: The above table is computed on the basis of a 120-day period of collecting hatching eggs and on a 50% production of eggs suitable for hatching. *The average daily feed consumption is figured at a sufficiently high level to cover the heavier breeds of birds at average feed intake, (29 lbs. of Complete Laying Ration per 100 birds daily, or 17.5 lbs. of Breeder Mash and 11.5 lbs. of scratch grain per 100 birds daily). The table makes provision for feeding these rations through the entire laying year.

EXAMPLE: If a change to Wirthmore Complete Laying Ration enables a poultryman to secure a rate of hatchability of 71-75%, he would receive from a hatchery paying a premium rate equivalent to that indicated in the table, a premium of 14c per dozen over the existing wholesale market, or \$116.66 per 10,000 eggs. At a rate of 50% production of eggs suitable for hatching, 167 birds would be required to produce 10,000 hatching eggs in four months' time. At a consumption rate of 29 lbs.* of Wirthmore Complete Laying Ration per 100 birds daily, 167 birds would consume 8.83 tons in a year. Therefore, dividing \$116.66 by 8.83, the resulting figure—\$13.22—would represent the extra value in each ton of feed in the case of that particular poultryman.

EGGS

More Quality - Greater Demand

The permanent bond between a poultryman and his customers is the quality of his products. The best market and the best-paying market year in and year out can be developed and held only by always delivering the quality that satisfies.

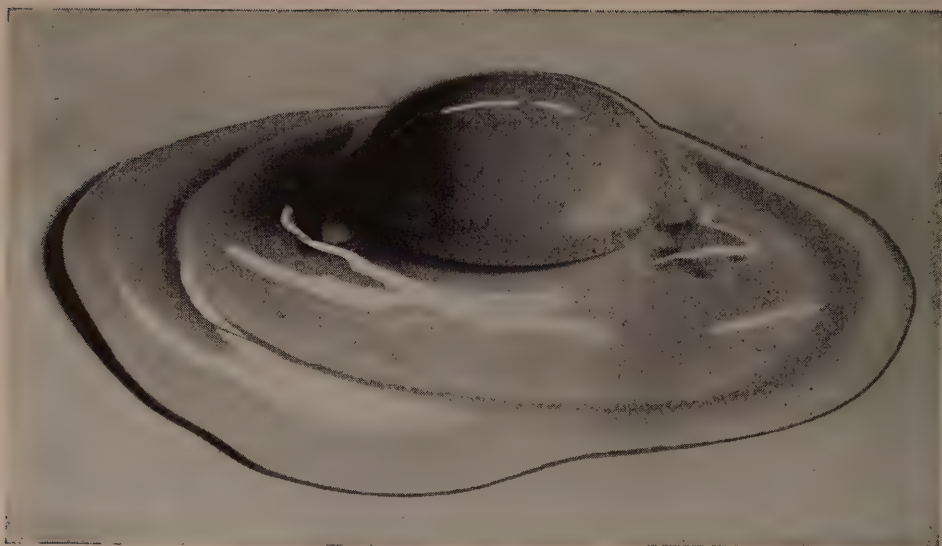
Both an obligation and an opportunity present themselves to the poultry industry in this business of producing the best eggs of the greatest food value. Eggs are without question one of nature's most valuable foods for humans. By proper handling of the flocks that produce them, their food value may even be improved. By proper handling of the eggs until they reach the consumer, more of their initial quality may be delivered.

While the poultry industry is considering means to develop increased egg consumption, each and every poultryman can take the first and by far the most important step in building that market. By adopting methods which will produce fewer inferior eggs and more superior ones, he and his associates will accomplish a big part of the task of leading the consumer to increased buying of eggs the year round.

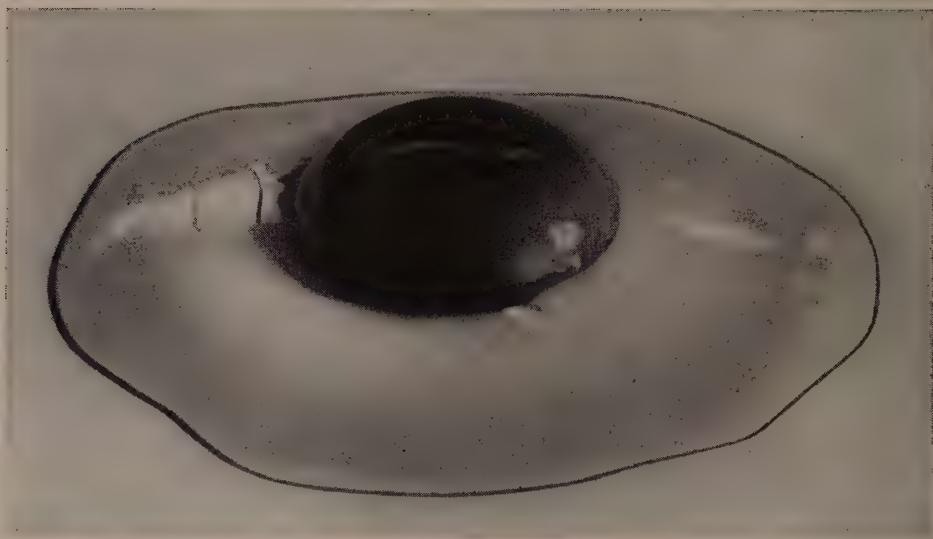
Consumers may or may not analyze the reason for their satisfaction with good eggs. They know that they like them or don't like them, but not always why. The producer should recognize the characteristics of quality eggs and understand the ways to produce such eggs.

The Consumer's Standard

Eggs that satisfy have firm smooth shells. The twelve in a box are uniform in size, shape, and color. When opened, the interior indicates, above all, freshness. The clear, light-yellow yolk stands up perfectly, held in shape by the firm thick white surrounded by a minimum of thin white. The aroma and taste are delicate and fresh. Several eggs broken out together are alike in yolk color and in quantity of contents.



Thick, Clear White, Upstanding Medium-Yellow Yolk, Appetizing Flavor, Rich Vitamin Value
—the Reward of Good Management and Good Feeding.



Watery Whites, Dark Yolks, Uncertain Flavor—Such Eggs Do Not Bring the Highest Prices
and Should Not Be Produced by New England Poultrymen.

Defects which detract from this given standard are numerous. Many are obvious to the eye, to the taste, or to the sense of smell; others are found by candling. A knowledge of the causes of these defects and the use of equipment and methods which will prevent their occurrence will result in a bigger percentage of top-grade eggs. Candling methods have been developed to measure the extent to which eggs will approach perfection. Save for a few exceptions which time and experience will eventually change, the present methods of candlers do indicate relative quality.

How the Hen Makes an Egg

A perception of the process by which an egg is formed answers some of the questions concerning characteristics of eggs.

The ovary and the oviduct are the two main parts of the hen's reproductive system.

The ovary is the seed-bed of the yolks. It is attached to the backbone of the bird in the area between the kidneys and the lungs. It is tissue which includes and to which is attached the thousands of yolks. As many as 3,000 ova may be present in a single hen. In the laying hen, the yolks range in size from those which are all but ripened, down to those which are barely visible. Each yolk is contained in a thin skin-like covering called the yolk follicle and is attached to the main stalk of the ovary by the follicle.

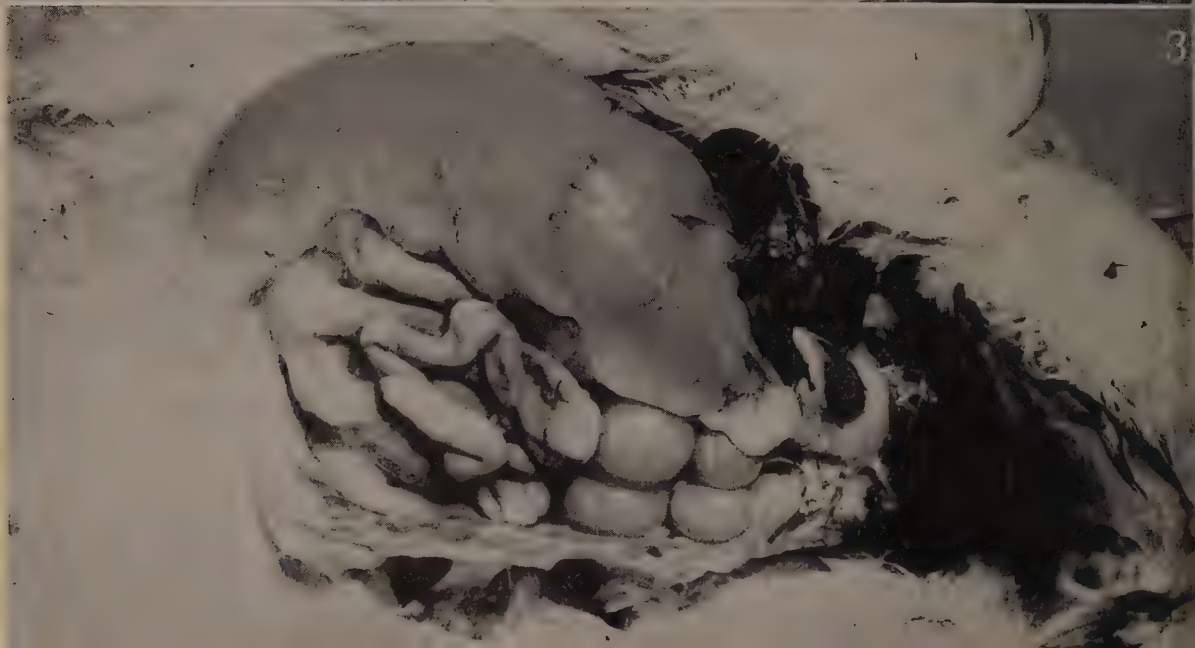
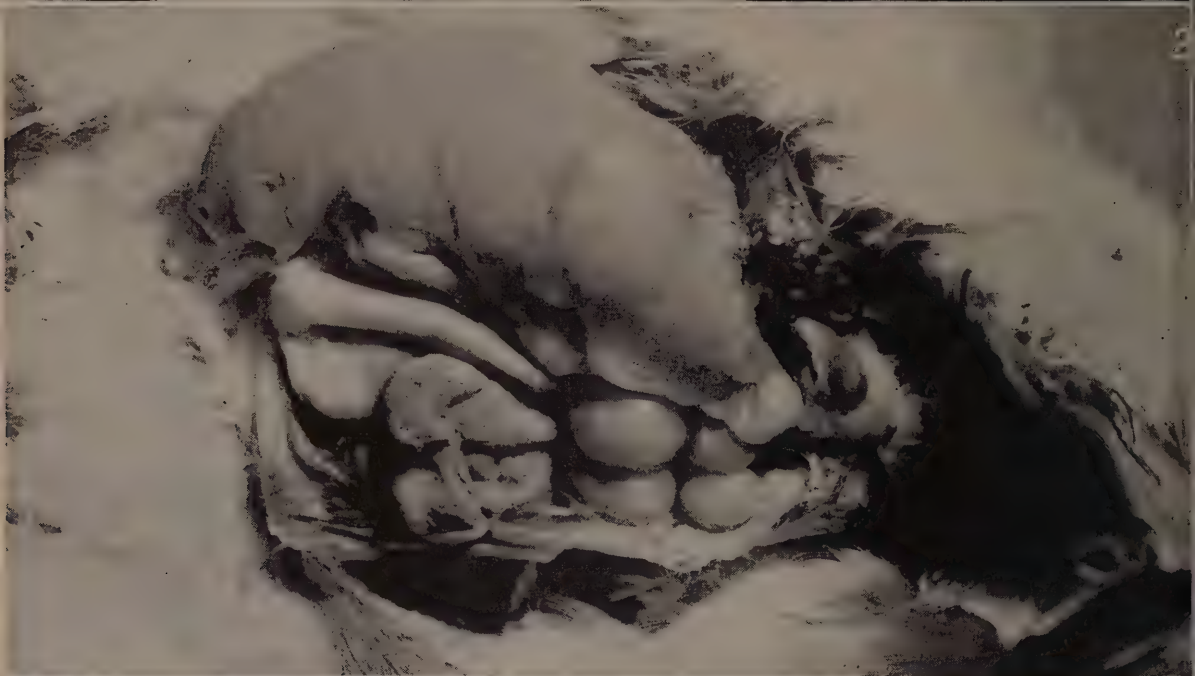
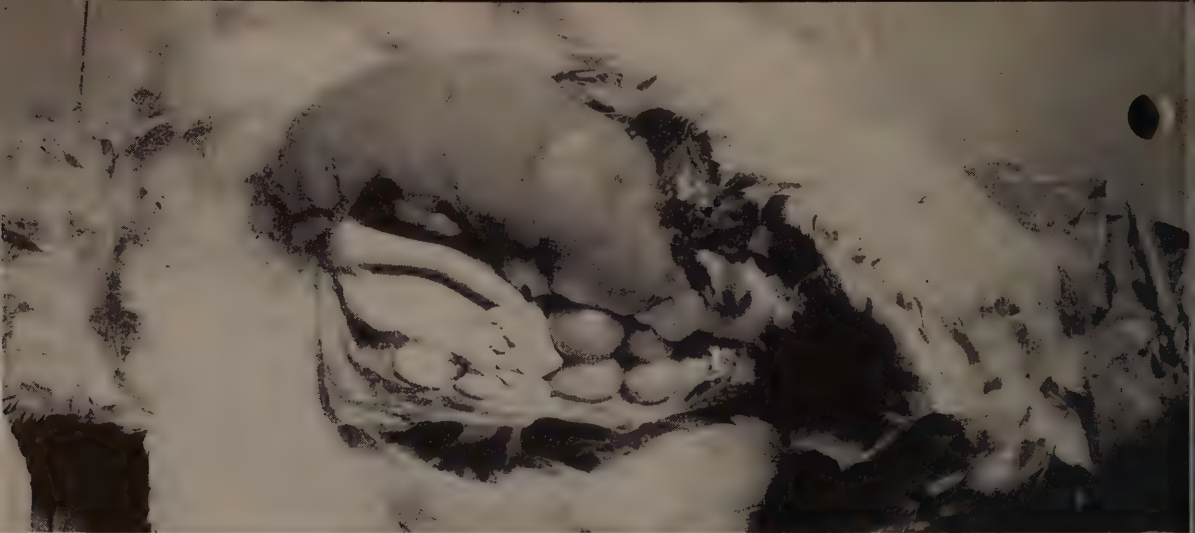
The oviduct is the entire tubelike organ in which the yolk is surrounded by albumen, shell membrane, and shell, and through which the egg passes so that it can be laid. The parts of the oviduct are called:

1. The infundibulum.
2. The albumen-secreting section.
3. The isthmus, in which the shell membrane is secreted.
4. The uterus, or shell gland.

About 45 to 75 days are required for an ovum to mature from the time that it starts developing. Usually, as one egg is laid, the exertion and straining on the part of the hen causes the yolk follicle on the next ripened yolk to rupture. It ruptures along a line which is free from all blood vessels. The released yolk falls through a short space into the tissue at the inside end of the oviduct, known as the infundibulum. The infundibulum engulfs the yolk and starts it on its journey through the oviduct.

For about three hours the yolk is in the albumen-secreting section, and the glands secrete around it the inner thin albumen, the thick albumen, and part of the outer thin albumen. Here also the chalazae, or ends of the yolk hammock, are made. The chalazae are formed from a protein substance made of protein fibers and water, which surrounds the yolk and the ends of which extend out into the albumen. The oviduct rotates the yolk and the albumen so that the ends of the protein fibers are twisted, the fibers pulled tightly, and the water in the protein fibers is squeezed out. This leaves only strong protein fibers holding the yolk in the center of the albumen, and the twisted ends of the fibers form the chalazae.

Next the egg passes through the isthmus where the inner skin or shell membrane is secreted in about one and one-quarter hours. After this, by means of an osmotic process, the rest of the outer thin

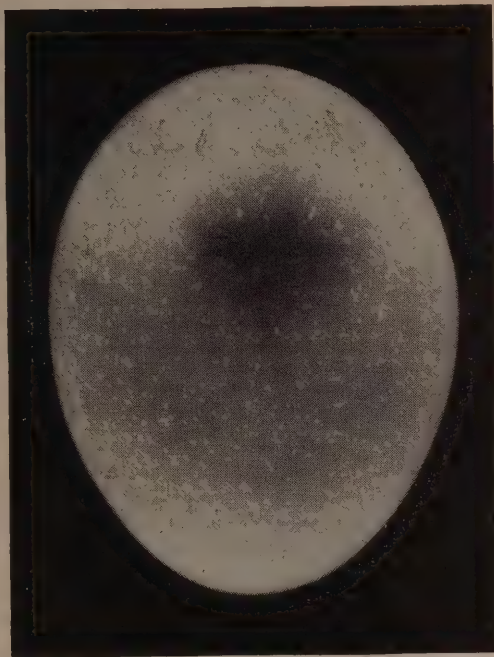


WHERE EGGS ARE MADE

1. Breast and digestive tract of the hen laid aside to expose the reproductive organs. Showing yolk cluster on ovary, infundibulum, and oviduct, all in their normal positions.
2. Infundibulum folded back to show where yolk is engulfed into the oviduct. Note the line of rupture on the yolk follicle.
3. Oviduct exposed to show its entire length, including the albumen-secreting section, the isthmus, and the uterus which in this case contains an egg with the shell recently completed.

time a yolk follicle ruptures.

Some Abnormal Eggs



Blood Spots Occur by Accident when a Blood Vessel Is Ruptured as the Yolk Is Released from the Ovary.

albumen is put inside of the shell membrane, filling the shell membrane tightly. This process of secreting and filling the shell membrane requires about $18\frac{1}{2}$ hours. In the next hour and a half, the shell is secreted within the uterus.

On the average, the egg is laid in about 26 hours from the

Blood spots occur if, when the yolk follicle breaks, a blood vessel is ruptured, allowing a drop of blood to follow along with the yolk.

Double yolks or triple yolks result when the cycle of ovulation is irregular and allows two or three yolks to break away from the ovary and travel down the oviduct together.

Meat spots develop when a tiny piece of tissue sloughs off from some part of the reproductive system and is included with some part of the albumen.

Misshaped eggs are the result of the permanently abnormal shape of the uterus or some temporary constriction in it.

Soft-shelled eggs are due to

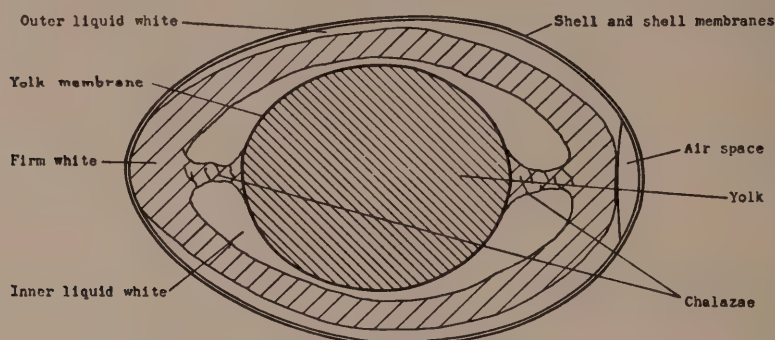
misfunctioning of the uterus.

Yolkless eggs follow the stimulation of the glands which secrete the albumen, the stimulation being caused by anything at all except a yolk.

Normal Eggs

Every normal egg is composed of eight distinct parts. The yolk is held together by a yolk membrane or very thin skin surrounding the yellow material. The chalazae, the ends of the yolk membrane, extend out-

ward into the firm white and together with the yolk membrane form a hammock for the yolk. A layer of thin white is deposited directly outside the yolk membrane. Outside that is the thick white. Another layer of thin white lies between the thick white and the shell membrane. The shell membrane surrounds all this other material, and the hard shell encloses everything.



Interior arrangement of the hen's egg.

(Illustration Courtesy H. J. Almquist, University of California.)

The space at the top of the egg between the white and the shell membrane, known as the air space, is always found upon candling, but is formed after the egg is laid. It is due first to the contraction of the contents,—the result of the decrease in temperature from body heat to room temperature—and later to evaporation of the contents of the egg.

Chemical Composition of the Hen Egg*

	Refuse (mainly shell)	Water	Protein	Fat	Ash	† Total
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Whole egg	11.2	65.5	11.9	9.3	0.9	98.8
Whole egg (edible portion)		73.7	13.4	10.5	1.0	98.6
Egg white		86.2	12.3	.2	.6	99.3
Egg yolk		49.5	15.7	33.3	1.1	99.6

* Langworthy, C. F., "Eggs and Their Value as Food." U. S. Dept. Agr. Bulletin 471, 29 p., illus., 1927.

† The difference between these total percentages and 100 is made up of undetermined substances.

Egg Characteristics and Their Origins

The number of stars beside the character indicates the relative importance or frequency of the cause given at the head of each column.

	Heredity	Feed	Handling	Age of Bird	Accident
Weight	***	**	*	***	
Shape	****			**	*
Shell Color	***	*		***	
Shell Texture	***	***	*	**	**
Yolk Color	**	***			
Mottled Yolk			**		**
Flavor		***	***		*
Firmness of white	****	*	***	*	
Dirty Eggs			***		
Abnormal Odors		*	***		*
Large Air Cell			***		
Tremulous Air Cell			***		
Vitamin A Content		****			
Vitamin D Content		****			
Blood Spots	*			*	***
Meat Spots	*			*	***
Blood Rings (fertile eggs developing)			***		
Stuck Yolks			**		*
Mold Spots			***		

How to Produce Top-Grade Eggs Through Breeding

Breeders have an opportunity to gain the desirable characters in eggs by deciding from which eggs their chicks shall be hatched. Because there is a strong tendency for hens to lay eggs similar to the eggs from which they themselves were hatched, much can be accomplished by selecting eggs at the incubator.

Weight of Egg

Weight of egg or egg size is dependent largely upon age of the birds and upon heredity. By setting the hatching dates wisely, it is easily possible to have pullets reach the desired age and desired stage of egg production so that more large eggs are obtained at a certain season of the year. Through breeding, egg size may be improved or maintained at a satisfactory level. Weighing eggs from the trap-nest is the most accurate way of measuring egg size of a family. According to the New Jersey Experiment Station, taking weight records in the fourth month of production only is as equally accurate as weighing eggs all the year. However, if the age of the layers is taken into account, much progress is possible from year to year through selection at the incubator. Elimination from the breeding pens of the earliest maturing pullets and pullets too light in weight at time of maturity will also tend to eliminate small-egg birds.

Egg Shape

Egg shape, determined by the build of the oviduct, can be controlled only by selecting hatching eggs. The desirable shape avoids extremes. Too long, too round, and too pointed shapes are the undesirable styles.

Shell Color

Shell color is largely an inherited characteristic. By selecting at hatching time, the breeder can develop shell color more nearly to his ideal—tinted well for brown eggs, free from tinting for white eggs—and in either case as uniform as possible.

Thin or Watery Whites

Thin or watery whites are now known to be frequently a family trait. Both the condition of the firm albumen and the proportions of thin and firm white are influenced by heredity. Watery whites are detected under the candler. By eliminating such eggs from the hatching trays, or better still, by locating the families that are the worst offenders and removing them from breeding pens, much of the watery white can be avoided in successive generations. Good hatchability is an indication of good-quality egg whites.

Yolk Color

Yolk color is determined to some extent by breeding but not nearly as much as by the ration fed.

Shell Texture

Shell texture is to some extent the result of inheritance. Some birds continually handled and fed like all the others in the flock will lay poor-textured shells regardless. Shells that are too porous, too thin, or covered with lime spots are poor hatching eggs.

How to Produce Top-Grade Eggs Through Feeding Egg Weight

Though largely controlled by heredity, egg weight is influenced some by the ration the birds receive. A plentiful supply of a ration containing proper quantities of quality proteins and needed minerals tends to increase egg weight. A complete ration is apt to show an advantage over a scratch-and-mash ration in this respect because the scratch-and-mash system allows the birds that prefer to do so to eat enough scratch feed to reduce the quantities of essential proteins and minerals below the most satisfactory levels.

Shell Color

Shell color is slightly dependent on the feed of the birds. The pigment material must be generously supplied day after day, or at the last end of the laying season eggs will become chalky white.

There is bound to be some less pigment at the latter part of the season than at the first, but a constant supply of pigment materials will prevent the production of eggs devoid of pigment.

Thin White

Thin white or watery albumen is affected to some degree by the birds' feed. Assuring that the birds receive a proper supply of the various proteins and minerals from which the eggs are formed is the logical procedure to follow.

Yolk Color

Yolk color variations are due principally to the kinds of food making up the ration. Dark yolks, light yolks, and intermediate shades result from eating varying quantities of pigment-carrying materials, the xanthophylls. The user of eggs likes uniformity of yolk color. Such eggs are more pleasing than a platterful of eggs of multishaded yolks. A ration which does not permit individual birds to select certain materials in preference to others will produce yolks more uniform in color. Too liberal allowances of green feeds, green weeds, alfalfa, and heavy quantities of corn will darken yolks.

Flavor

Egg flavor which is fresh and not strong is dependent upon a ration of quality materials in balance. Moldy or decaying materials will produce strong odors and flavors. "Fishy flavor," quite commonly blamed on the feed, is not caused by feed but by changes in bodies of individual birds.

Shell Texture

Shell texture is influenced by nutrition. Minerals must be in balance and vitamin D must be present in sufficient quantities to enable the bird to manufacture shell material properly.

Vitamins A and D

Vitamins A and D are present in greater quantities in the best eggs. These vitamins are so essential in the diet of humans, and eggs can be such excellent carriers of both vitamins that there is an opportunity for the poultryman to perform greater service for his customers by assuring a high content of the vitamins in the eggs he produces. The quantity stored varies greatly and is directly dependent upon the quantities of vitamins A and D the birds receive.

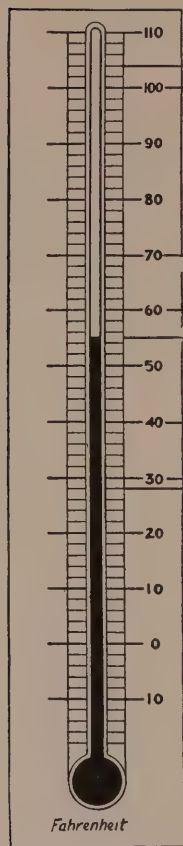
How to Maintain Egg Quality Through Handling

Weight of Egg

Weight of egg laid is less when air temperature is high. High temperature causes birds to secrete less albumen, and egg weight may drop one ounce or more per dozen in hot spells. Hence the construction and ventilation of a laying pen should be such that the house may be kept cool in the summer. Evaporation resulting from high hen-house

temperature takes place rapidly after the egg is laid. Frequent collections and removal to a cool cellar will avoid this loss of moisture. Cool eggs quickly. Market them frequently.

Effect of Temperature on Egg Quality



Correct Temperature for Incubation

Danger Range

Eggs Deteriorate Very Rapidly in Quality Between 70° and 100°

Fertile Eggs Start Germination at 69°

Avoid Holding Eggs above 60°

Suitable Temperature for Keeping Eggs at Farm, Store or Home

Most Favorable Cold Storage Temp. 29° to 30°

Eggs Freeze at 28°

Keep a Good Reliable Thermometer in Your Cellar or Egg Storage Room.

It May Help You in Detecting the Loss of Egg Quality

Courtesy Connecticut State Department of Agriculture

Thin Whites

Thin whites develop when eggs are stored in warm temperatures for long periods. When eggs are laid, there is more water in the thin portion of the albumen than in the thick portion. While they are held in storage, there is a tendency for the water content in the different layers of white to become equalized, resulting in a lesser relative quantity of firm albumen. Frequent collections and quick cooling are essential.

Temperature More Important Than Time

Some people believe that regardless of the conditions under which eggs are kept, an egg under a week old must be good. The fallacy of this belief is shown in following chart. Eggs were allowed to reach relatively the same degree of deterioration at varying temperatures.

No. of Days	Temperatures Fahrenheit
3	99.6
8	77.
23	60.8
65	44.6
100	37.6

The above table* shows the serious effect of warm temperatures on the quality of eggs although the length of time involved may be relatively short. It shows conclusively the danger of using age alone as a guide to quality.

* Powell & Sharp, Cornell University, Report of American Chemical Society.

Age and Improper Temperature

Age and improper temperature are both factors that cause deterioration in egg quality. Reducing the egg temperature to at least 60 degrees Fahrenheit as soon as possible will help to prevent shrinkage and lowering of quality. Wire baskets are used extensively for this purpose because they allow free circulation of air around the eggs. At Massachusetts State College it was found that eggs in wire baskets required five hours to cool to 66 degrees, those in galvanized pails nine hours, and those in egg cases 12 hours at the same room temperature. Shipping the eggs at least twice a week seems to be as important as proper temperature. In one trial involving four cases of eggs with room temperatures of 58 degrees and 70 degrees for periods of four and seven days before shipment, the following results were obtained:

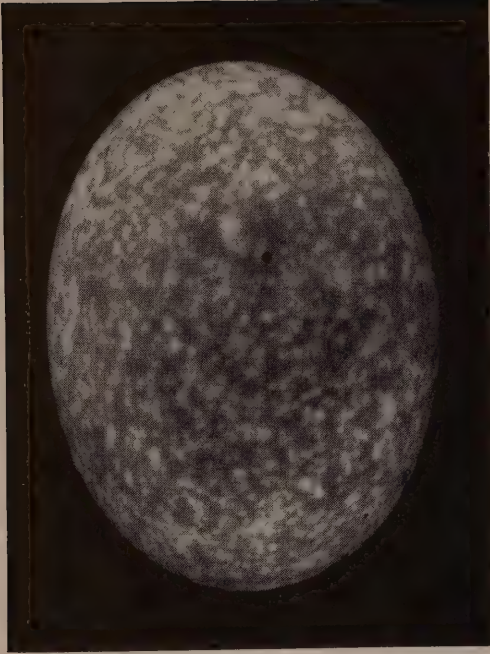
7 days at 70° F.—graded 20% Specials
7 days at 58° F.—graded 68% Specials
4 days at 70° F.—graded 74% Specials
4 days at 58° F.—graded 95% Specials

Flavor

Flavor of eggs may be materially changed in storage. Eggs quickly absorb odors of other foods, musty materials, and oils. Keep them away from all harmful odors.

Shell Texture

Shell texture may be ruined or improved by handling. Rough handling, improper packing, and jouncing in transit will increase the percentage of cracks. The so-called mottled shell is graded down at the grading stations as a porous shell. Actually these shells contain no more nor no larger pores than do smooth shells. Evaporation does not take place faster through them. The water content in these shells is distributed unevenly. If stored in a drying atmosphere they tend to lose their mottling and change to the type of shell a candler likes. A high humidity tends to increase the mottling of a shell, and egg shells of



The Mottled Shell is due to Uneven Distribution of Water in the Shell. Drying in a Cool Temperature Lessens the Amount of the Mottling.

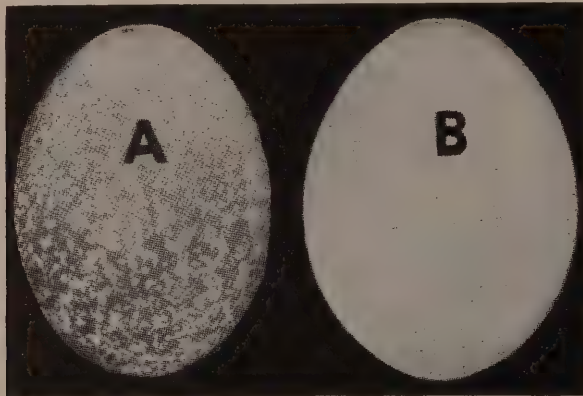
excellent texture at the start may acquire water spots if stored a few hours or a few days in a damp atmosphere. Ordinarily a humid air with ventilation will maintain egg quality best. If, however, too big a percentage of the eggs is called mottled by the candler, dry the room some.

Large Air Cells

Large air cells are entirely a storage problem. Temperature must be reduced quickly and humidity raised to prevent development of too-large air cells.

Tremulous Air Cells

Tremulous air cells are a result of jarring. Much of it develops in transportation. Battery floors that spring easily develop tremulous air cells quickly. When transporting eggs, place them in the truck where they will receive the least amount of shaking. If battery floors are to blame for the trouble, collect the eggs frequently.



Change in Candling Appearance of the Shell, Caused by Drying at a Low Temperature.
(Illustration Courtesy H. J. Almquist, University of California.)

Mottled Yolks

Mottled yolks, or heat spots, develop both inside and outside the hen's body. They are caused by an infiltration of albumen into the yolk fat. Heat aids the process. Quick cooling checks it.

Effect of Container on Cooling Eggs in an Egg Room (50° F.)

According to investigations made by Prof. E. M. Funk of the University of Missouri, the type of container affects the rate of cooling eggs very materially.

Hours	Single Egg	Wire Tray	Wire Basket	Galvanized Pail	Chilled Case	Warm Case
0	101.0	102.0	100.0	98.5	97.2	92.0
1	61.1	86.9	96.0	97.9	96.2	91.8
2	51.3	74.4	87.2	95.9	94.5	91.3
3		66.5	79.1	92.2	92.0	90.2
4		61.0	72.7	87.0	89.8	88.6
5		56.5	67.5	82.1	87.5	86.1
10			56.5	65.6	76.5	75.5

At an egg-room temperature of 50° a single egg can be cooled below germ-development temperature (69°) in one hour; eggs on a wire tray 3 hours; eggs in a wire basket 5 hours; eggs in a galvanized iron pail 10 hours; eggs in a chilled case 18 hours; and eggs in a warm case 20 hours.

Effect of Air Circulation on Cooling Eggs in a Wire Basket In an Egg Room (50° F.)

Hours	Still Air Egg Temp. °F.	Circulating Air Egg Temp. °F.
0	100	95.2
1.00	96	55.1
2.00	87.2	50.2

The table above indicates that one hour with circulated air will accomplish more cooling than 12 hours with still air.

Blood Rings

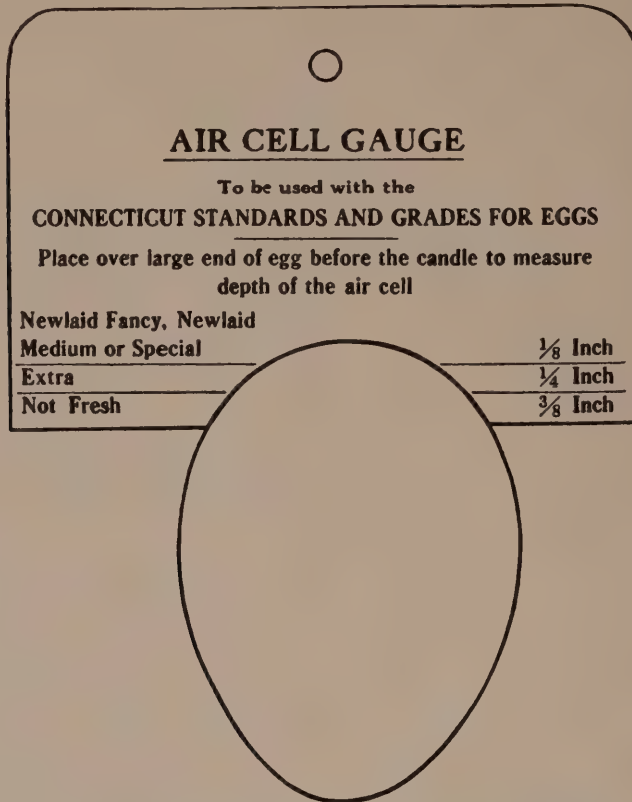
Blood rings, the first development of blood vessels in a fertile egg, are unnecessary. Holding eggs in a cool room will prevent them. As soon as the breeding season ends, males should be removed from the breeding pens. At times the chalazae are strong and thick and are mistaken for blood rings. Thick chalazae are signs of egg quality rather than defects.

Stuck Yolks

Stuck yolks and eggs with a yolk to one side or in some abnormal position have been held in one position under too high a temperature or, occasionally, they develop from cracked eggs. A low-temperature room, frequent marketing, or occasional turning if they must be held for a length of time will lessen the trouble.

Mold Spots

Mold spots are the result of eggs becoming musty from contact with musty fillers or pails, or of lack of ventilation.



Courtesy Connecticut State Department of Agriculture

Dirty Eggs

Dirty eggs are a nuisance on every farm. Plenty of clean nest litter and frequent collections reduce the number of dirty eggs. When layers have a range, the practice of keeping them indoors in muddy weather keeps the eggs cleaner.

Thirty-Eight Suggestions for Preserving Egg Quality In the Laying House

- Supply 20 nests per 100 hens.
- Use plenty of clean nesting material.
- Keep houses cool in summer.
- Avoid wet floors.
- Cover dropping boards or pits with wire.
- Keep hens indoors in muddy weather.
- Collect eggs frequently.
- Use open wire basket.



Here Is Where Management to Preserve Quality Begins—in Nests with Plenty of Nesting Material so as to Prevent Broken and Dirty Eggs.

Carry basket of eggs to egg room immediately.

Place a "date-laid" tag on the collection baskets.

In the Egg Room

Use a cool cellar room for the egg room.

Reduce egg temperature to below 60 degrees quickly.

Cool eggs in wire basket.

Delay packing in cases until eggs have cooled.



Grading Table at Rhode Island State College Poultry Plant, Showing Layout for Weighing, Candling, and Packing. Eggs Are Cooled in Wire Baskets.

Hold egg room as cool as possible.

Keep humidity high.

Ventilate by opening windows at night. Moisture without ventilation allows molds to grow.

Moisten air by sprinkling floor or hanging up wet bags.

At the Grading Table

Candle out blood spots, meat spots, blood rings, stuck yolks, mold spots, cracks, and blind checks.

Listen for the sound of cracked eggs as they hit against each other. The sound is dull, not metallic.

Weigh eggs of doubtful weight on rapid-weighing scales.

Have enough light in the room so that it is easy to see to clean and sort eggs.

Clean eggs the same day as picking. Dirty eggs allow bacteria to enter and hasten spoiling.

Clean slightly dirty eggs with emery cloth over a soft shoe cleaner or with fine steel wool.

Scrape very dirty eggs with a knife. Do not include them in quality packs. Dirt remains in the pores and deterioration starts more quickly.

Avoid washing. Water seeps through pores and carries bacteria with it. Washing makes shells shiny or spotty.



A Home-Made Egg Cleaner.

In the Case

Test tightness of bottom and sides of case. Replace or add necessary nails.

Avoid hot dry cases. Keep cases in cool cellar.

Never use musty cases or fillers.

Place first flat upside down for cushion, next flat right side up.

Use fillers without broken or wet partitions.

Pack eggs with small end down.

Place long eggs next to the center partition.

Put extra large eggs on top layer. Nail one-half inch strip at both ends and on middle partition to raise the cover.

Use a clean flat upside down on top layer. If there is room, place a second flat right side up on the first.

Put one flat over the middle partition so that cover will be sprung. Nail the case cover at ends only.

Cover egg cases in transit to avoid extremes in temperature.



MORE INCOME

From Meat

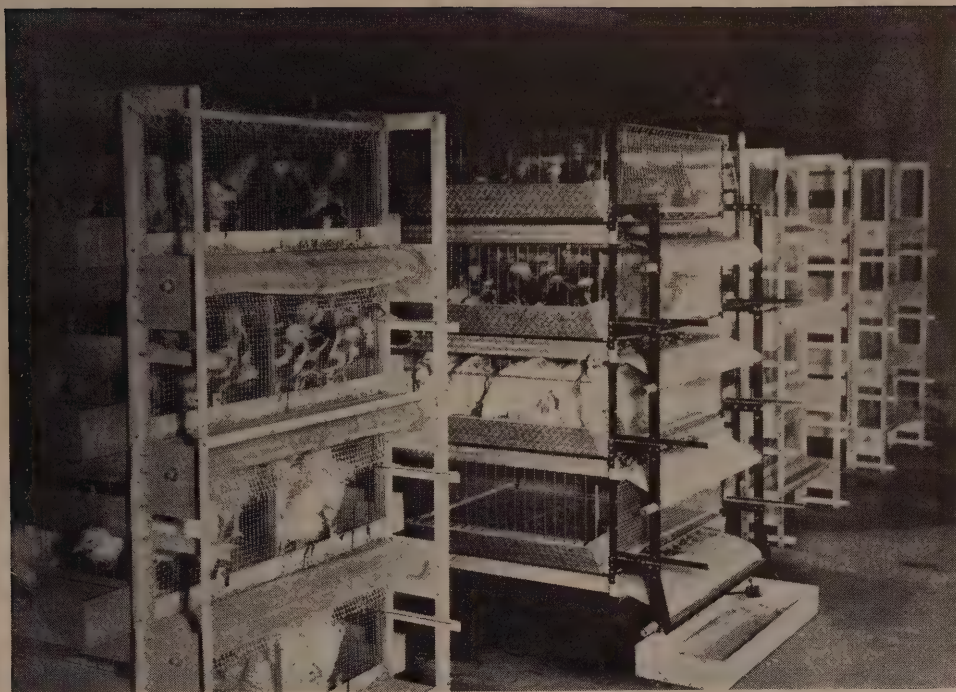
Meat is a by-product on most New England poultry farms today, and on many is looked upon as a necessary nuisance. Where this general attitude exists, it has become customary to invest as little as possible in thought, time, and money in producing and marketing the meat crop. Just as in the market-egg and baby-chick enterprises, so it is in the poultry-meat enterprise—any effort to make a better product more economically results in increased business and increased profit. Poultrymen who have made a business of meat production have found that this can be a profitable venture.

Growing and finishing male birds should be a definite part of every poultryman's program. The operations of finishing meat birds and, at opportune times, of raising roasters and capons would materially change the picture of the farm's meat business and add to the total farm profit.

Finishing the birds, when sold either alive or dressed, wholesale or retail, will average to bring a better price for the better quality birds and will bring extra income for the quickly added weight. Particularly at times when poultry prices are low, there is a sale for the better quality birds at a few cents extra per pound.

Broilers that would be ready for market at the period when broilers usually glut the market can well be held for roasters or caponized. Taking advantage of a deferred market at such times and in this manner most always turns a potential loss into a profit.

The specialized broiler and roaster plants which continue indicate that if poultry meat is properly produced, this phase of the business becomes a paying enterprise. Sexed chicks and sex-linked chicks have recently appeared on the chick market in such volume as to give new impetus to the production of better meat. Improved quality should be the aim of every poultryman raising meat. The number of low-grade market birds is due in the order of their importance: first, to disease; second, to poor feeding; third, to the selection of poor birds or breeds or strains not suitable for meat.



New England Has Many Battery Plants, Constantly Turning Out Hundreds of Broilers Weekly.

Meat Types

Real meat-type birds are round and meaty, not deep and angular like high egg-yielders. A poultryman specializing in meat alone would select his breed and strain accordingly. The bulk of poultrymen carrying on all the various enterprises would continue to select mainly for egg type, but in determining which birds to carry for later finishing would keep the meat type in mind. Yellow-legged, yellow-skinned, early-feathering birds are also much preferred.

There is a wide variety of breeds from which to choose. Barred Rocks, White Rocks, White Wyandottes, Rhode Island Reds, and New Hampshires all make excellent meat with each breed possessing some characteristic making it particularly suitable. The crossbreeds—Rhode Island Red on Barred Rock, Barred Rock on Rhode Island Red, White Wyandotte top-crossed with White Rock, and White Rock on Rhode Island Red all make good meat birds. Even White Leghorns, the eggliest of types, respond to the finishing process in such a manner as to make this work profitable with them.

Certain defects which place market birds in the lower grades are inherited, and through selection of the breeders, these defects should be gradually eliminated. Late feathering is the most common among these. Certain deformities are included, such as crooked backs and some of the crooked breastbones.

The Finishing Period

Finishing poultry adds weight, materially increases the quantity of yellow pigment, improves the quality of the meat, and thus places the birds in a higher market grade.

Up to the finishing period, the same general care and management program which produces the best results in growth and production also leads to the highest quality meat.

The finishing period may well be identical in procedure for the various classes of meat birds. In preparation for the finishing period, birds on range should be brought into closer confinement, given shelter and a reasonably small yard. The birds already in confinement will remain where they are.

At the start of the period, cull from the flock any sickly, misshapen, or stunted birds. It will not pay to feed them the extra feed. They will be using space which the better birds should have, and even after the fleshing period, these culls will still be thrown in the low-grade class. Sell the culls immediately for what they will bring.

Three Wirthmore systems of feeding in the finishing period are available—two using Wirthmore Fleshing and Fattening Mash; the other using Wirthmore Fleshing Pellets.

One method of using Wirthmore Fleshing and Fattening Mash is to feed it dry in hoppers before the birds at all times during the fattening period, replenishing the supply once daily, and accompanying it with one feed daily of Wirthmore Fleshing and Fattening Mash moistened to a crumbly consistency. The quantity of moist mash which will be cleaned up in about 15 minutes is fed once daily. It may be fed on top of the dry mash in the hoppers. A supply of clean water must be available. This method of feeding may be employed for periods up to three weeks.

The second method of using Wirthmore Fleshing and Fattening Mash in finishing is to use it as a wet mash without any mash in dry form at all. Three to five feedings a day are given, pouring the wet mash into open-trough hoppers. Drinking water must be available. This method is suitable for a shorter finishing period, ten days at the most.

There is danger in extending either of the above feeding periods beyond the recommended time because of the possibility of birds going off feed. If, toward the latter end of a feeding period, a flock shows signs of going off feed, pass up one feeding and then continue feeding again. Repeat this procedure if necessary.

A third Wirthmore system of feeding in the finishing period employs the use of Wirthmore Fleshing Pellets. Under this system the pellets are gradually added to the feed which has been used until the initiation

of the finishing period. It requires a few days for the birds to become accustomed to the pellets so that they will eat appreciable quantities. Pellets are fed once daily, increasing the quantity as rapidly as the birds will consume them, but avoiding the use of quantities greater than will be consumed in a day. As more pellets are consumed, the daily quantity of mash fed is reduced until it is replaced entirely by pellets. This pellet method of fattening may be used up to three weeks, or if the condition and appetite of the birds warrant, it may be continued for a longer period.

If the birds are to be dressed at home, it is best to starve them for one day before they are killed, in order to empty the crops. If the birds are to be sold alive, this is unnecessary as the crops will have time to empty on the way to market.

Broilers

Cockerels should be separated from the pullets as early as is convenient. Whether they are on range, in a yard, confined to a house, or in batteries, the practices which make for good growth must be adopted for best results. Avoid crowding, provide plenty of feed and clean water, plenty of hopper space, and remove any cull birds as soon as they appear.

Rate of growth up to broiler age varies greatly so that it is impossible to state that any specific breed or flock of broilers on any given feed will weigh so much at a certain age. The inherited faculty of growing quickly or slowly makes a difference. The vigor of newly hatched chicks, the brooding conditions, the ration used, the freedom from disease, are all variable factors. The more clever a poultryman becomes at selecting and controlling each of these factors, the greater is his success.

During the finishing period and under ordinary farm conditions, two-pound Rock broilers could be expected to add from one-half to three-quarters of a pound each. Red broilers of the same initial weight would be likely to add one-half pound or a little more. Leghorn broilers would probably add a little less than one-half pound apiece.

Feed consumption, also, will vary greatly between different flocks, but for estimating costs and returns and deciding whether to sell birds as broilers, caponize them, or hold them for roasters, one would be safe on figuring that on an average it takes about three pounds of feed per pound of broiler if the broilers run between two and three pounds each. In comparison, the birds held later than that require more feed per pound of bird, a five-pound or six-pound bird requiring around five pounds of feed for each pound of live weight. More feed is eaten per day during the finishing period, but the rate of gain per pound of feed is slightly better than in the prefinishing period.

Roasters

Roasters up to five or six months old usually meet a ready market if well developed and especially if properly finished. They respond best to the fattening process commencing at about the time they begin to "comb up" and before they become "staggy." At broiler age the poor birds should be culled, and only good ones held for roasting chickens.

A green range, with some brush available, makes an ideal location for growing roasters. Cool shelters, large enough to avoid crowding, should be furnished.



Wyandotte Roasters In An Ideal Growing Location.

Either one of the Wirthmore growing feeds is efficient for the growing period. Wirthmore Complete Growing Ration may be fed alone, or Wirthmore Growing Mash may be used together with Wirthmore Scratch Feed. The scratch feed may be either hand-fed or left before the birds in hoppers. Both rations supply plenty of carbohydrates and the necessary animal proteins, minerals, and vitamins for growth and for meat production.

During the finishing period Rock roasters and Red roasters will gain around one-quarter to one-half pound apiece.

Capons

Capons provide an opportunity for avoiding a temporarily poor broiler market and reaching a more profitable market later. The operation of caponizing is easily managed. Any one with a steady hand, good eyesight, and without a distaste of operating on live animals can learn to caponize. In most every community there is a person who specializes in caponizing for hire. Capons make a softer meat than

roasters and continue to be soft regardless of age. They weigh practically the same as roasters at roaster age but they may be held longer than roasters because they do not become "staggy." It is from roaster age on that they put on their extra weight, and yet because the extra weight is usually more costly than the gains up to that point, a higher market price is essential.

Capons should be handled on range just the same as roasters. They are less trouble, however, because there is less fighting among them and less chasing of the weaker ones.

Males should be caponized when they are around two months old before there is much development of combs and wattles and while the testes are still small.

For 24 hours before caponizing the cockerels should be confined without feed, and for the last 12 hours without water. The intestines are then empty and are easy to move out of the way of the instruments.

For a day following the operation the birds should be given mash and water but no hard grains. Air puffs may develop on some birds. These may be opened with the point of a knife if they seem to distress the bird, but most of them will disappear if left alone.

It will take about five to six pounds of feed for each pound of capon grown to market time.

In the finishing period capons will increase in weight from five to ten per cent. If they have been on range, they fatten better if given a house and yard than they will in batteries to which they are unaccustomed.

Fowl

The finishing of hens is the least certain of becoming an economical venture. Sickly birds will not respond to the finishing quickly enough. Most healthy fowl due to be sold because it is out of production carries good weight anyway. Some that happen to be slightly underweight but healthy would add the weight and add it quickly. Birds that are starting to molt will not respond to finishing. If they are to be sold, they should be sold immediately.



A Fowl After Semi-Scalding.



Lower jaw removed to show location of cuts—first in the rear left to sever the jugular vein, second through the rear of the groove in the roof of the mouth to stick the brain.

Where a retail market demands a certain number of dressed fowl every week, it would pay to have a finishing pen. The added color would enable the poultryman to satisfy the best trade.

Killing and Picking

Killing and dressing on the farm pays as well as any other operation on a poultry plant. A properly laid-out and properly equipped killing room turns a less desirable chore into a pleasant business operation.

Birds should be starved for 24 hours before killing to free the crop of all material.



Showing the location and position of the knife to get the stick that releases the feathers.

The most common and still the most efficient way of killing is with a poultry sticking knife. With the bird suspended by a cord and block or by a suspension hook, the operator holds the head in the left hand, puts the knife in the mouth, and cuts the back of the mouth with a sideways slit, just back of the groove in the roof of the mouth. This

bleeds the bird well. The knife is then turned and pushed up through the groove in the roof of the mouth toward the top and back of the head to a point above the ear. If the stick is done correctly, it causes the bird to squawk and quiver as the knife enters the brain. A cut in the rear part of the brain destroys the nerve that controls the muscle around each feather, and the feathers are then released easily.

A weighted can is hooked into the lower beak to catch the blood, to keep the bird extended, and to prevent thrashing.



Pliers Make A Good Stick Sure.

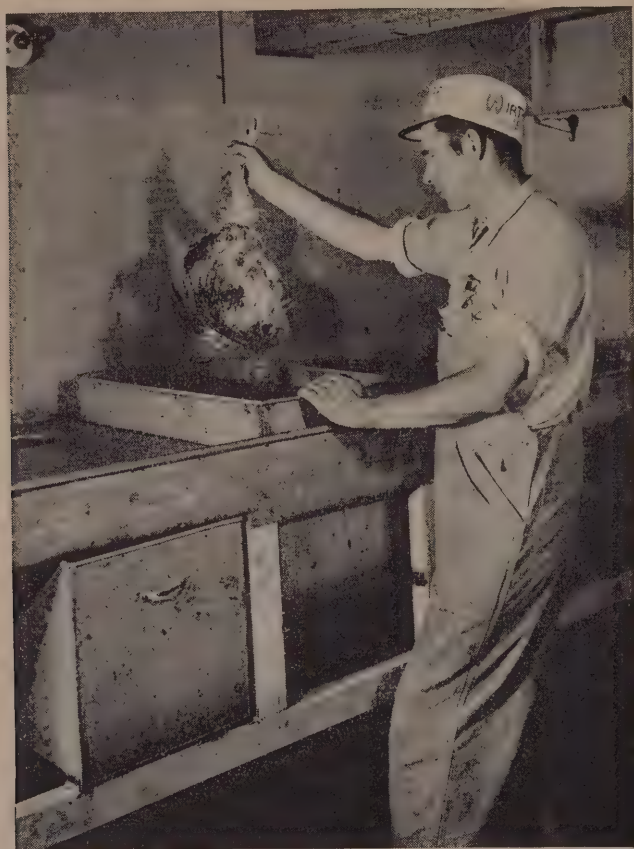
Killing With Killing Pliers.

Electric killers now on the market give a fair release of feathers if the electrodes are correctly placed. A man accustomed to using a knife can usually get a better stick, however.

Killing pliers are satisfactory, especially for those not killing frequently enough to become adept with a knife.

Dry-picking is entirely satisfactory for a man used to killing and picking.

The semi-scald method of picking finishes a bird just as well as dry-picking if it is correctly done, and it would save most poultrymen much time. After the bird is killed and thoroughly bled, the carcass is im-



A Semi-scald tank with electric heating element designed to hold the temperature between 126 and 130 degrees.

mersed in water heated to quite an exact temperature. Fowl, roasters, and capons should be immersed for 50 to 60 seconds in water ranging from 128 to 130 degrees Fahrenheit. For young chickens the water should be 125 to 127 degrees, and they should remain in the water from 36 to 38 seconds.

While the carcass is in the water, it should be kept in an up-and-down motion to soak under all the feathers. The exact time and temperature between the given limits will be found by noticing the first few birds. The feathers should just reach the stage where they pull easily.

A small tank with thermostatic control would be of great assistance where any quantity of killing was to be done.

Properly done, a semi-scald leaves a bird as pretty as a dry-picked chicken. Note the suspension hooks, sticking funnel, blood pan, and feather box.



Roughing Is Easy After a Proper Stick And Semi-Scald.

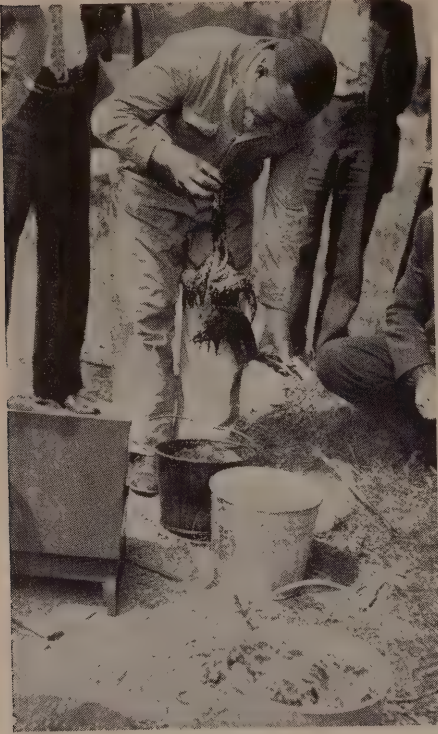
Since the development of a patented wax and patented process of wax-picking poultry in packing plants, some poultrymen have adopted this picking method for farm use. The process starts like the semi-scald method, dipping the bird into the water which is around 128 degrees, and then rough-picking.

After roughing, the bird must be thoroughly dried. The process of



Farm Outfit For Wax-Picking.

drying on the farm is accomplished by hanging the carcass in a room to dry or by putting it into a box of dry sawdust and rubbing the saw-



Wax-Picking Demonstration.
(Illustration courtesy Prof. G. T. Klein,
Extension Poultry Husbandman, Massa-
chusetts State College.)

dust against the skin. When the bird is dry, it is then dipped into a tank of wax, the wax being about 128 degrees Fahrenheit. The bird is held by its feet and head when it is dipped in so that the feet and head are not covered with the wax. The bird is taken out and dipped again. It is then dipped in cold water, usually a tank of ice water, to harden the wax. The wax is pulled off, and all the remaining feathers, hairs, and any dirt present should come with it. The wax on the feathers is reclaimed by melting and straining.

If enough birds are picked to warrant the effort of preparing to wax-pick and clean up afterward, this method becomes practical.

There are many ways to prepare the birds for sale. If they are going to market, the marketman will dictate the method of preparation.

For retail sale the number of ways of preparing them is only limited by the imagination of the poultryman. A poultryman building a retail business can well afford to educate customers to the different types of poultry he has available and the many different ways of using them.

It will be well for the poultry industry and for the consuming public when all concerned understand and recognize that the better meated, well-finished bird furnishes more meals per dollar. It pays to buy and it pays to sell higher grade poultry.

The GENERAL HEALTH

of the Poultry Flock

The safeguard and maintenance of health is a basic factor in the successful management of a poultry flock. As in any other livestock production, problems of disease must be faced continuously. Their scientific study belongs to the province of specially trained men. For the poultryman a knowledge of the fundamentals of poultry ailments and their control is an indispensable tool of good management.

Important advances in the knowledge of poultry diseases during the last few years have made advisable a complete rewriting of the following section in this, our sixth edition of "Timely Topics on Poultry Management." In this section we have attempted to present the opinion of numerous scientific workers in the field of poultry diseases combined with that of the Wirthmore Poultry Service group. Recommended treatments have well-recognized limitations and should be considered as temporary remedial measures. The principal factors in disease control are good sanitary feeding and management practices.

In the preparation of this section we are especially indebted to Dr. Erwin Jungherr of Connecticut State College for suggestions and editorial comments and also for permission to reproduce illustrations No. 6 to No. 14 inclusive.

Poultry Mortality

Disease in a broad sense is the expression of a disturbed balance among the living things in nature. Although disease problems are responsible for a certain percentage of the death rate in wild animals, they immediately gain in economic importance wherever artificial concentration takes place.

The poultry industry as a whole has experienced phenomenal growth and development in recent years, primarily by concentrating birds in a comparatively small area and increasing the unit output. It has not been so successful in coping with the hazards of disease. No marked

progress has been made in decreasing the average rate of mortality, and the indications are that the adult death rate is on the increase.

To gain insight into the mortality problem, various factors should be taken into consideration: heredity, nutrition, and disease. Good management is the intelligent application of these basic scientific principles.

In these days of specialization not every poultryman can be a successful breeder. Knowing the importance of hereditary factors in poultry mortality, the prospective purchaser must make careful inquiry into the vigor and livability of the parent stock.

It is likewise impossible for the busy poultryman to keep abreast of the scientific advances in poultry nutrition. Good feed is essential for intensive production. By using thoroughly reliable commercial rations such as Wirthmore Feeds, the poultryman not only obtains the essential nutritive elements in suitable proportions, but also avails himself of the resources and control methods which only a large feed service can command.

By contrast, health or freedom from disease cannot be bought in the ordinary sense. The days of curing poultry diseases by putting "something into the drinking water" have passed, and only a few drugs are recognized as having any real value. Even if certain ailments seem to be unavoidable at the present time, the majority of poultry diseases is preventable. Thus, the control of poultry diseases is primarily a function of farsighted management for which the responsibility rests with the poultryman.

Types of Diseases

Diseases are classified according to their cause. An understanding of the nature and habits of the various causative agents of diseases is helpful in the intelligent application of control measures.

BACTERIAL diseases are caused by bacteria or germs which belong to the smallest forms of plant life known. Many useful species exist in nature; others, such as the pullorum germ, are capable of causing a specific disease. Nonspecific germs live in unclean surroundings of poultry equipment and may attack birds of lowered resistance. Certain germs form "seeds" or "spores" which are highly resistant to disinfectants.

FUNGOUS diseases or mycoses are caused by disease-making molds; being higher forms of plant life, these molds ordinarily live outside the body. Disease may be brought about by exposure to massive infection such as occurs in overcrowding and similar unsanitary conditions.

PARASITIC diseases are caused by small forms of animal life which depend primarily upon the body of the bird for a livelihood. On the

lowest rung of the ladder stand the one-celled animals or protozoa which comprise the coccidia. The higher developed parasites, consisting of many cells, are represented by worms and pests.

VIRUS diseases are caused by microscopically invisible agents which can pass through filters that would retain ordinary bacteria; they have been termed "filterable viruses." Being invisible they can be differentiated only by their "fruits," that is by the type of disease they induce. Notwithstanding their small size, or possibly on account of it, "filterable viruses" are more infectious and contagious than any of the other disease agents.

NUTRITIONAL diseases are due to an inadequate food supply in kind. Congenital forms may occur in very young birds if the feed of the parent stock was deficient in essential dietary factors.

Poisonings, like nutritional diseases, are forms of chemical injuries and may be due to the ingestion of outright poisonous substances like rose chafers, or excessive doses of otherwise beneficial materials like table salt and baking soda.

Diagnosis of Diseases

The diagnosis of a disease is the result of the combined observations of symptoms, gross and microscopic tissue changes, bacteriological examination, and other laboratory tests. Not all of these tests are necessary in every case, but an accurate diagnosis is essentially a laboratory procedure. In view of this fact, diagnostic laboratories are maintained in the New England States, a list of which is given below:

STATE	ADDRESS	FEE REQUIRED	
		Resident	Non-Resident
MAINE	J. F. Witter, Animal Pathologist College of Agriculture University of Maine Orono, Maine	NONE	NONE
NEW HAMPSHIRE	Poultry Pathology Laboratory University of New Hampshire Durham, New Hampshire	NONE	\$2.00
VERMONT	Poultry Disease Laboratory State Dept. of Agriculture Montpelier, Vermont	NONE	NONE
MASSACHUSETTS	Dept. of Veterinary Science Massachusetts State College Amherst, Massachusetts	(See Note) NOT EXAMINED A specimen (shipment) is to consist of not more than five chicks or two adult birds from one farm. No fee when submitted at suggestion of County Agent or his representative, or when specimens are brought to the laboratory by the owner; all other specimens, \$2.00.	
RHODE ISLAND	Dept. of Animal Industry Poultry Autopsy Laboratory East Farm Rhode Island State College Kingston, Rhode Island	NONE	NONE
CONNECTICUT	Dept. of Animal Diseases Storrs, Connecticut	NONE	NOT EXAMINED

Shipment of Specimens for Laboratory Diagnosis

The careful poultryman makes wise use of the diagnostic facilities offered but will not abuse them. Two to ten representative specimens should be submitted to the home-state laboratory soon after the start of a disease outbreak. It is best to ship specimens alive by express.

The accompanying letter of transmittal should contain the following data: name and address; number, age and breed of all birds on the premises and of birds in affected houses; number of birds sick and dead from suspected disease; symptoms and lesions observed in the field; treatment applied; and other points of interest. It takes from three to seven days to obtain a report by mail. Avoid shipping birds so as to arrive on a week-end or holiday. If it is necessary to send dead birds, make certain they are thoroughly cooled before packing.

Field Diagnosis

To be equipped for emergencies and for better understanding of disease problems in general, the poultryman should take every opportunity to open birds in the field. This is done on a heavy layer of newspaper in which the carcass is wrapped for disposal by burning at the completion of the examination.

For ordinary post-mortem work one needs a sharp knife, a pair of scissors (preferably with one blunt point), and good light. The bird may be killed by disjuncting the neck; it is then placed on its back and skinned. After turning out the thigh bones, the abdominal wall is incised along the arc of the ribs, and the breastbone laid back to expose the internal organs. Then the intestinal tract is removed by severing it from the gizzard and vent attachments, and freed from the adherent tissues. Close inspection of the exterior intestinal wall often reveals dotlike whitish or reddish lesions as evidence of intestinal coccidiosis; the interior wall or mucous membrane is exposed by splitting the entire tract with the aid of scissors. Small roundworms and tapeworms can be seen by floating the opened intestine in salt water contained in a glass dish over dark background. Other organs may then be inspected for evidence of disease.

Control Methods

Even before the nature of a disease can be ascertained, the first bird showing suspicious symptoms should be promptly eliminated from the flock. This "stitch in time" saves many a nine. Based upon a correct diagnosis, two general control plans of infectious diseases are available: eradication and vaccination.

The *eradication* plan is designed to rid the premises permanently of a particular disease. Not all birds sick with or recovered from a certain

disease show conspicuous symptoms; many apparently healthy birds remain *carriers* of the disease and a hazard to other susceptible birds.

If means are known to detect carriers of a specific disease, all birds on the premises should be tested and positive reactors removed at once.

If no practical means of detecting carrier birds is known, all adult birds should be disposed of before the young stock raised in strict quarantine is housed.

DISINFECTION is an important adjunct to an eradication plan and to any sanitary program, but its real value must be properly interpreted. Organic matter destroys the germ-killing properties of chemicals within a short time. "Elbow grease" or mechanical cleaning must be the preliminary step, followed by a thorough washing with scalding lye solution, one to two pounds per ten gallons of water. Thereafter, disinfectants are applied with a spray gun, broom or brush.

For ordinary purposes, coal-tar disinfectants should be used, either United States approved, or reliable commercial brands which show their relative strength in terms of carbolic acid (phenol coefficient) on the label. The relative cost of disinfectants can be figured out from the following formula:*

$$\frac{\text{cost of 1 gallon stock disinfectant}}{20 \text{ times phenol coefficient}} = \text{cost 1 gallon of disinfectant diluted for use}$$

Other types of disinfectants are used for special purposes.

* From Connecticut Agricultural College Extension Bulletin 178.

VACCINATION. This method of control should be resorted to if the eradication plan has no chance to succeed. Commercial vaccines, effective if properly prepared and stored, are obtainable for fowl pox and laryngotracheitis; they are live disease agents and likely to establish and maintain a focus of infection on the premises.

Do's and Don't's from the Standpoint of Disease Control

1. Buy close to home where you can learn something about the parent stock, or raise your own replacements.
2. Buy day-old chicks from state-tested, pullorum-clean flocks or hatcheries.
3. Buy stock with a background of hen breeding (two years or older) and with a known low incidence of fowl paralysis and tumors.
4. Follow sanitary practices; one can carry disease on shoes or clothing.
5. Feed the right way. Use a good commercial ration.
6. Watch the health of the flock; get a correct diagnosis as soon as disease occurs.
7. Don't introduce started chicks, pullets, cockerels, or vaccinated birds; they may be disease carriers.

8. Don't return birds from poultry shows, auctions or egg-laying contests.
9. Don't entertain visitors or friends in or around the poultry houses.
10. Don't let old feed bags or dirty crates come onto the farm.

Diseases of Brooder Chicks

Certain diseases have a tendency to be more prevalent during the brooding period than during the growing period and vice versa, but this grouping does not imply that the diseases cannot occur in older or younger chickens respectively.

Pullorum Disease

Pullorum disease is the most important bacterial disease of chicks and chickens, probably the world over. The New England States have had a systematic program of eradication in force for several years and lead in the number of pullorum-clean flocks.

CAUSE. The disease is caused by a specific germ (*Salmonella pullorum*) which has strong disease-producing power for baby chicks, adult chickens in production, and somewhat less so for turkeys, pheasants, and other birds. Its economic importance is derived from the fact that adult carriers may transmit the germ through the egg to the chick, and under the conditions of modern incubation to chickens from noninfected eggs in the incubator. Transmission also takes place by way of the droppings.

SYMPTOMS AND LESIONS. The former name, B. W. D., short for "Bacillary White Diarrhea," characterizes the principal symptom which may be developed to various degrees. Dead chicks usually show enlarged liver, unabsorbed cheesy egg yolk, yellowish nodules in the heart and lung, or cheesy exudate in the blind guts. Adult female carriers often exhibit cheesy, discolored so-called "blighted" ovarian follicles.

Conclusive evidence of the presence of the disease can be obtained only by laboratory demonstration of the causative organism.

TREATMENT AND CONTROL. Although a specific cure is unknown, the death rate of chicks can be somewhat lowered by sanitary measures, stepping up the brooder temperature, and feeding sour milk. Since carriers may survive, the affected lot should be marketed as broilers.

PREVENTION of the disease consists of securing hatching eggs or day-old chicks from known "pullorum-clean" sources. Various states publish from time to time a list of pullorum-clean and pullorum-passed flocks which should be the buyer's guide. Any one desirous of cleaning up his breeding flock can apply for an official blood test for the detection of affected breeders.

The terms "pullorum clean," "pullorum passed," and "pullorum tested," as defined by the National Poultry Improvement Plan, mean that two, one, and no reactor-free tests respectively have been applied to the breeding stock. The former inaccurate term, "blood tested," means that the parent stock is in the preliminary stages of pullorum-disease control, but does not give a guarantee against the introduction of the disease.

Paratyphoid

This is a rare disease of chicks and turkeys which acts similar to pullorum disease. Diagnosis only by laboratory examination.

Interest in this disease comes from the fact that similar organisms have been found responsible for cases of human food poisoning. Rats and mice may be natural carriers and spreaders of these germs, and outbreaks of paratyphoid have been observed following floods in incubator cellars and brooders.

Common Diarrhea

In distinction from the foregoing specific bacterial infections, common diarrhea is frequently associated with nonspecific filth and dust germs. These organisms rarely attack chicks unless they are in a weakened condition.

SYMPTOMS AND LESIONS. Affected chicks show diarrhea or "pasting-up"; no distinctive post-mortem alterations are observed except small yellowish liver, distended gall bladder and soft bendable bones.

TREATMENT AND PREVENTION. In the prevention of the malady, strict attention should be paid to avoid *chilling* and *overheating* of the chicks, especially by proper insulation and ventilation.

After culling of severely affected chicks, an Epsom salts flush is recommended, measured out at the rate of one level teaspoonful per gallon of water for six to eight hours in the morning, followed by fresh lukewarm water in the afternoon. During and after the flushing period, the brooder temperature should be somewhat raised.

Navel Ill (Omphalitis)

The disease is due to a wound infection with nonspecific filth and dust organisms and results from unsanitary conditions in the incubator and hatcher or possibly from high relative humidity at time of hatching. The open wound is due to improper closure of the navel following the drawing-in of the yolk sac into the abdominal cavity.

SYMPTOMS AND LESIONS. Losses occur within the first ten days of life. Affected chicks appear groggy, pasted-up and pot-bellied. In the wet form (mushy chick disease) which occurs within the first

three days, the entire body tissues are swollen and slimy; in the dry form the lesions consist of hemorrhages, pus pockets, or scabs in the navel region. The egg yolk is large, adherent, easily breakable, and discharges a crumbly material. In older runts one frequently finds dried pus in the yolk stalk in evidence of an earlier navel infection.

PREVENTION is a matter of *incubator sanitation* in the broad sense. Hatching eggs should be clean and uniform in size in order to permit uniform drying at time of hatching. Chicks showing large unhealed navel openings should be culled before shipment.

Fumigation of the incubator equipment is indispensable in continuous operation. If preceded by thorough cleaning and washing, ordinary germs and viruses are killed within 60 minutes by releasing commercial formaldehyde at a humidity of 68° (wet bulb reading 90° F.; dry bulb reading 100° F.) at the rate of one ounce of formaldehyde together with one-half ounce of potassium permanganate, or 0.56 ounce formaldehyde released from cheesecloth, per each 100 cubic feet of incubator space. This dosage may be used for 12 to 24 hours on empty incubators or twice for five minutes each at 12-hours' interval in the hatcher.

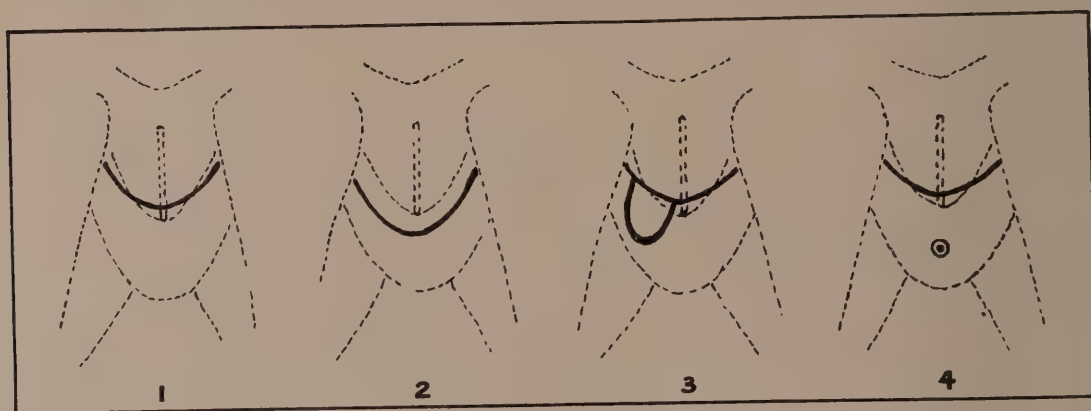


Figure 12.

DIAGRAMMATIC ILLUSTRATION OF COMMON BABY-CHICK DISEASES.

(For examination, skinned chick is placed flat on its back.)

1. NORMAL: margin of liver (heavy line) inside tip of breastbone.
2. PULLORUM DISEASE: margin of enlarged liver reaching beyond tip of breastbone.
3. CHILLING OR OVERHEATING: liver normal in size, enlarged gall bladder.
4. NAVEL ILL: liver normal in size, hemorrhages or scabs in navel region.

Fungous Diseases (Mycoses)

Of the poultry diseases caused by molds three should be mentioned: favus, brooder pneumonia, and sour crop.

FAVUS affects the head and wattles where it brings about the development of whitish to yellowish disklike lesions. The disease occurs primarily in the laying house, is nonfatal, and can be treated by paint-

ing the lesions with tincture of iodine and glycerine (half and half) after removing the crusts.

BROODER PNEUMONIA or aspergillosis is due to an infection of the respiratory tract with aspergilluslike molds. The difficult breathing shown by affected chicks finds its explanation in yellowish nodules in the lungs and air sacs. Differentiation of this disease from pullorum disease is a laboratory procedure.

At the first definite evidence, the houses, utensils and floors should be thoroughly cleaned and disinfected, and the litter (and possibly the feed) replaced because the trouble is sometimes imported with moldy litter.

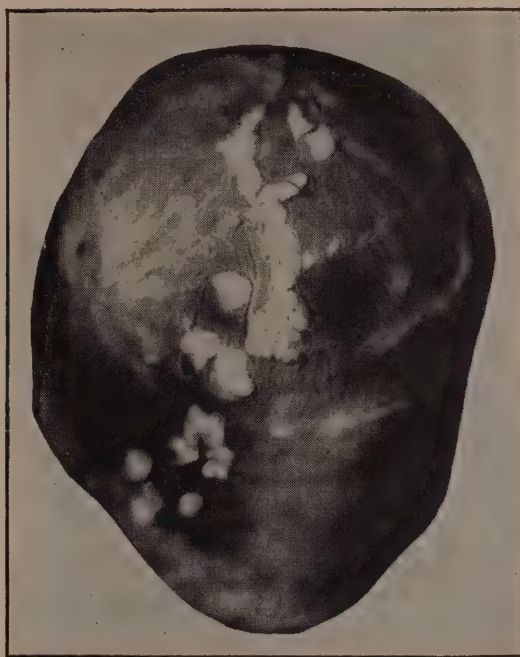


Figure 8.
Inverted crop of a chick affected with thrush or sour crop (Moniliasis). Note the whitish round ulcers.

SOUR CROP (thrush) is due to an infection with yeastlike molds (Monilia). Affected chicks, young turkeys or quail lack definite symptoms, but post-mortem examination reveals grayish soft nodules or membranes in the crop.

TREATMENT by general sanitary measures. Powdered bluestone (copper sulphate) in the drinking water seems helpful when offered in earthenware vessels at the rate of one level teaspoonful per two gallons of water on alternate days of one week. The recommended way to put the powdered bluestone in the drinking water is, first, to dis-

solve the bluestone in a small quantity of boiling water and then add the resulting solution to the drinking water. In epidemic cases, dipping hatching eggs in Iodine Suspensoid is suggested.

Blackhead

This protozoan disease of turkeys has lately made its appearance in chicks during the late brooding or early range period.



Figure 14.
Liver of Chick Affected With
Blackhead.

The disease is caused by a one-celled animal parasite (*Histomonas meleagridis*) which under natural conditions is transmitted in the pinworm (page 174) egg. The characteristic post-mortem changes consist of swollen blind guts filled with layers of cheesy exudate, and dark red, slightly depressed liver lesions, the color of which is relieved in places by yellowish dots or rings.

Prevention can be accomplished by fly and pest control in the brooder house and keeping chicks away from infected hen and turkey runs. Attempted treatment designed to control the pinworm infestation is either turpentine (one to five ounces sweetened with a few drops of almond oil per 100 birds aged 6 to 14 weeks, given in a wet mash twice a day on three alternate days) or standardized tobacco powder.

Coccidiosis

Although recognized as a disease of birds for over half a century, the economic importance of coccidiosis dates back to the advent of mass production and has been termed a "man-made" disease. It seems impossible to eradicate the malady from the farm but it can be checked by careful management.

CAUSE. Similar to blackhead, the disease is caused by protozoan parasites known as coccidia. They multiply in the intestinal cells at an enormous rate, causing havoc and destruction; after a sojourn through the animal body of from four to seven days, they pass in the droppings in a noninfective stage; these egg-shaped parasites or oocysts become infective again after ripening or sporulating from one to two days. To go to completion, sporulation must occur in a warm moist place relatively free from putrefaction. Once the coccidia have sporulated, they are resistant to ordinary disinfectants and can survive in sheltered places for six months to two years; they are immediately killed by contact with boiling water and more slowly killed by the heat and ferment-

tation developing in the course of natural decomposition. Six different species are known to affect chicks; from the practical standpoint, blind gut and intestinal (chronic) coccidiosis should be considered.

SYMPTOMS AND LESIONS.

The blind-gut form (cecal, bloody) is suspected from the appearance of bloody or dark-colored droppings in chicks over three weeks old. Post-mortem examination reveals a pale carcass in good flesh, and greatly swollen blind guts filled with blood or cheesy cores.

Intestinal coccidiosis occurs somewhat later than does the bloody form and its onset may go unnoticed. In the most severe form, the "necatrix" or killer type, the birds are acutely ill, exhibiting loss of appetite, sunken eyes, watery crop, and constipation.

According to the type of coccidia involved, post-mortem lesions vary from increased mucus in the intestine to distention, thickening and roughening of the intestinal wall; whitish and reddish dots on the surface often give the intestine a speckled appearance.

In the early spring, intestinal coccidiosis may bring about a thickening and softening of the bones akin to rickets.

CONTROL. From the extreme sanitary precautions of former days, poultrymen have come to favor now the "deep-litter" idea because an early mild infection seems to build up a degree of immunity against a particular coccidial type. Although to gauge the proper quantity of "mild" infection is difficult, certain practices can be recommended:

Young birds should be reared in strict quarantine from older birds which are frequently coccidial carriers. Cleaned and scalded brooder houses should be bedded with absorbent litter (protected by paper for the first few days) which is stirred frequently and kept free from caked portions. A normal floor covering of two to three inches may be used during the first two or three weeks and additional litter added to the depth of five to six inches.



Figure 2.
Infected Caeca Normal Caeca
1. Exterior 1. Exterior
2. Interior 2. Interior

Use one-inch-mesh wire platforms under feed hoppers and drinking fountains in houses or on range.

Depending on age and breed, allow not less than one-half square foot per bird up to four weeks of age, then one to four square feet.

Keep brooder houses dry and well ventilated. If necessary, insulate them to accomplish this purpose.

Drain and cover the approaches to the chicken houses with coarse gravel; sprinkling with slaked lime and sulphur is helpful.

As soon as possible, separate sexes to make more room per bird.

Do not let birds run out soon after a wet spell.

Since excess lime is harmful, do not use soluble grit during the brooding period.

Practice range rotation and sanitation; short-type vegetation and high shade trees are preferable.

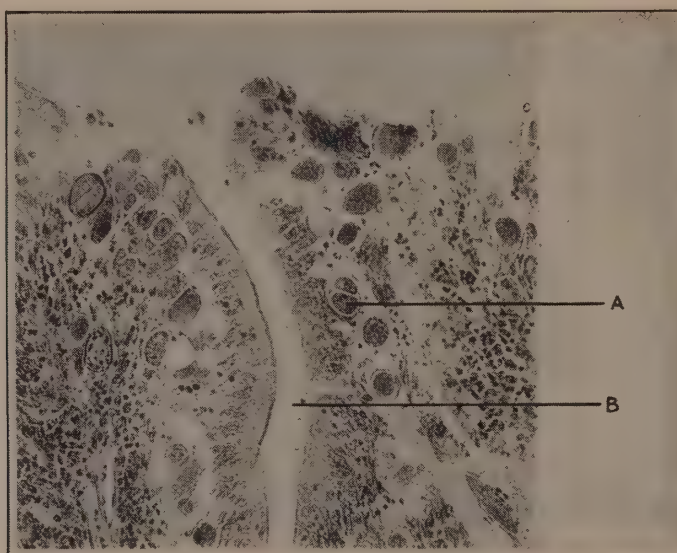


Figure 9.
Section of middle part of small intestine of chick infected with acute intestinal coccidiosis (*Eimeria necatrix*):

- A. Developing form of *Eimeria necatrix*.
- B. Space between two intestinal folds.

TREATMENT. Be on the lookout for the first suspicious case and don't spare the ax. If an outbreak occurs, cull at night and on the next morning flush for six to eight hours with Epsom salts, one to three teaspoonfuls per gallon of water, depending upon age of chicks; then give fresh lukewarm water. The second morning is devoted to a thorough cleaning and scalding of the houses. During the next two weeks add six to eight per cent of dry skim milk to the mash. If the flush is given on range, the birds should be confined in a suitable enclosure during this period. Sanitary measures are outlined under the paragraph on "Control" (page 161).

Epidemic Tremor

Only recently recognized, the disease receives its name from the trembling symptom shown by affected chicks (two to six weeks old) in the head, neck or tail, especially on excitement. Paralysis of the legs with or without tremor is the most common clinical sign.

The disease is thought to be due to a filterable virus affection of the nervous system, but its mode of transmission is unknown at the time this book is published. The malady appears rarely in successive hatches from the same flock.

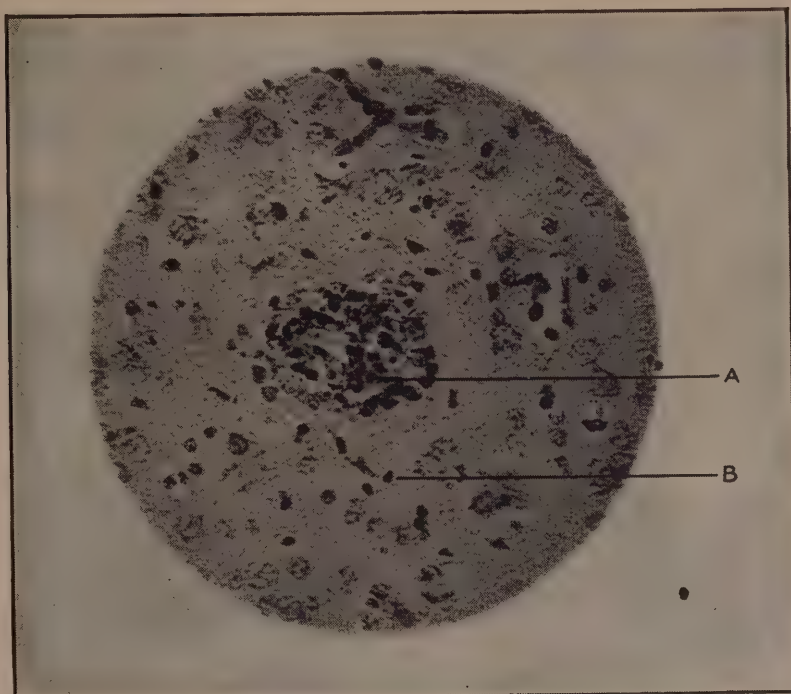


Figure 10.
Section of brain of 14-day-old chick affected with epidemic tremor:
A. Characteristic focus of abnormal cells.
B. Normal brain tissue.

Post-mortem examination fails to show characteristic lesions with the exception, perhaps, of yellowish discoloration of the body tissues. The only certain means of diagnosis is a microscopic study of the abdominal sweetbread, spinal cord, and brain. No treatment is known. Affected flocks should be culled and may be flushed with Epsom salts.

Leg Weakness or Rickets

Lack of sunlight or insufficient vitamin D in the ration brings about a nutritional disorder in growing birds known as rickets or rachitis. The condition may occur in baby chicks if the feed of the parent stock was deficient in the preventive factor. Rickets occurring during the

late brooding or early growing period sometimes results from intestinal coccidiosis.

The symptoms vary from painful gait to complete prostration according to the severity of the affection; on post-mortem examination the ribs appear caved-in, the breastbone crooked, and the joints thickened, while the bones are rubbery and bendable.

TREATMENT to be applied soon after the first cases have been accurately diagnosed consists of feeding remedial quantities of cod liver oil and in correcting a calcium shortage if it exists. Two per cent of U. S. P. grade cod liver oil or its equivalent in vitamin D potency mixed into the ration is a curative dose. Since cod liver oils vary in vitamin D potency, 85 D units being the U. S. P. standard, an oil of different potency should be used only in the quantity needed to provide an equivalent vitamin D unitage. Oyster shells or limestone grit can be hopper fed to correct a known calcium deficiency but should not be used with a normal chick starter unless it is definitely known that a shortage of calcium does exist. Curative measures should usually be discontinued after five to ten days, the flock then being fed a normal protective ration. Wirthmore Feeds for the breeding stock and chicks contain the rickets-preventive factor in standardized proportions.

Slipped Tendon

This condition, also known as *hock disease* or *perosis*, is another nutritional disorder of growing birds which is characterized by deformities in the legs, but the bone tissue itself is of normal hardness. The hock joints are apt to appear puffy, the shanks curved and flattened at the lower aspect.

The condition is thought to be due to an abnormal mineral balance in the feed. Excess amounts of calcium and phosphorus are usually associated with the occurrence of slipped tendon. Secondary factors such as heredity, crowding, overheating, and wire floors play a role. Of late, the lack of small quantities of essential minerals, especially manganese, is considered to be an important factor related to the occurrence.

No treatment of developed cases is known. Prevention should be sought through the use of chick rations not unduly high in calcium and phosphorus content. Chick rations should also contain the "trace" mineral elements, especially manganese, in the proper amounts. Control measures must include management that eliminates the secondary factors which play a role. It has not yet been found possible under practical conditions to prevent slipped tendon entirely.

Gizzard Erosions

The uncomplicated form of gizzard erosions in very young chickens has been shown to be due to the lack of a dietary factor not identical

with any of the known vitamins. Gizzard erosions have been found in chick embryos in late incubation stages and in day-old chicks. Some investigators report that only occasionally have they found chickens under six weeks of age with gizzards entirely free of lesions even on the best type of rations. Others state that the occurrence of erosions, if any, is very slight when practical rations containing wheat bran and alfalfa are fed. The gizzard factor which prevents these lesions is easily destroyed. The best practical sources of the factor yet found are fresh and dried greens, and wheat bran.

Secondary forms of gizzard lesions occur in association with pullorum disease, mold infections, etc.

The diagnosis is based upon finding erosions in the hard lining of the gizzard; this membrane may become readily detachable and show lesions on the underside.

TREATMENT should depend upon whether the lesions are uncomplicated or complicated with secondary infection, and also upon the type of ration being fed. The addition to a normal chick starter of five per cent kale, lawn clippings, or cabbage is suggested. When no fresh greens are available, the addition to a normal chick ration of five per cent alfalfa leaf meal and five per cent wheat bran is suggested as a remedial measure. Under some practical conditions the bluestone treatment outlined on page 159 has been helpful in controlling lesions complicated with mold infections.

Crazy Chicks

This disorder occurs in rapidly growing chicks two to seven weeks old and receives its popular name from the fact that affected birds show symptoms of droopiness which rapidly progress to staggering, paralysis, somersaulting, and backward rotation.

On opening, the carcass is found to be in excellent flesh, but the kidneys may be pale and enlarged. The characteristic gross lesions are observed by splitting the scalped head lengthwise; the small brain

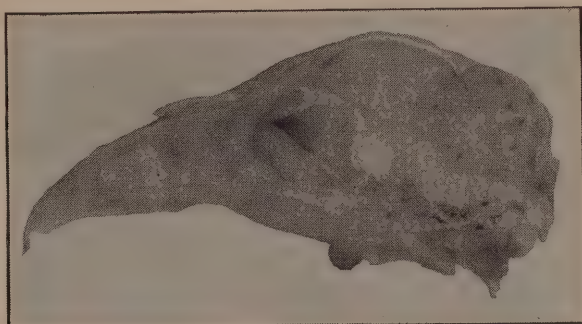


Figure 13.
Cross Section of Head Showing Hemorrhages in
Crazy Chicks.

just above the nape appears swollen, water-logged, softened and dotted with fine hemorrhages. The field condition resembles an experimental condition which can be produced in chicks on simplified diets lacking in certain vegetable oils. As a practical *treatment*, darkening the pens

and "starving" the chicks for several hours each day over a few days' period, or flushing the birds with Epsom salts is recommended. Special attention should be paid to good ventilation in the wintertime and, in general, to maintaining a normal growth rate.

Nutritional Paralysis and Pellagra

These conditions rarely occur under practical field conditions. They affect chicks from two to five weeks of age. Nutritional paralysis is characterized by weakness in the hocks, and by an incurving of the toes not to be confused with what is commonly called "crooked toes." Pellagra is characterized by dry scabs on the corners of the mouth and on the eyelids.

Nutritional paralysis is associated with a deficiency of flavin; pellagra with a deficiency of the filtrate factor.

These disorders may be confused with epidemic tremor, other forms of paralysis, simple eye colds, or even the sticking of mash to the beak. Thus, when either of these troubles is suspected, diagnosis should be secured from a competent source.

TREATMENT should consist of the addition of either five per cent of liver meal or ten per cent of dried milk to a normal ration for a period of five to ten days.

Poisoning

Poisoning is more often suspected as the cause of poultry losses than actually proves to be the case.

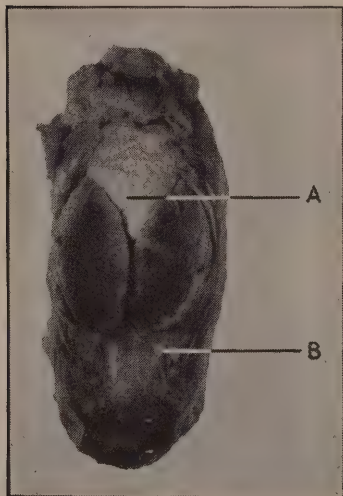


Figure 11.

Body of two-day-old chick affected with gout:

- A. Heart sac completely covered by white deposit.
- B. Round white deposits on abdominal wall.

BAKING SODA, and rarely Epsom salts, used in excessive doses for flushing may cause a diseased condition indistinguishable from gout. The kidneys, heart, and liver appear large and covered with whitish sugarlike material.

SALT POISONING is rare because chickens can tolerate much more table salt than is ordinarily found in commercial rations. On the other hand, sudden changes from a low to a high salt diet accompanied by lack of water (insufficient or improper fountains) may be responsible for losses in baby chicks.

ROSE CHAFERS are brown insects with three pairs of spiny legs. They are poisonous to chickens under ten weeks of age. These "rose bugs" are most numerous during June and should be looked for in the crop of any chick dying suddenly on range.

For prevention, birds should be kept inside during the dangerous season or ranged very cautiously on short grass where rose chafers are less apt to alight.

METAL POISONING is not infrequent. The use of milk in metal containers leads to development of poisons when the lactic acid reacts on the metal. Milk should be fed in earthenware or wooden containers.

Diseases of Growing Chickens and Adult Birds

The mortality problem in adolescent and reproductive birds is of especial economic importance because every loss means a decrease in the principal of the long-time investment represented by stock, labor, feed, and houses. In the broiler business, with a relatively quick turnover, mistakes are often subject to remedy in the subsequent lot; infringements upon the sanitary laws for adult birds are costly and difficult to amend. From this standpoint, *good management during the brooding and growing period* is the primary factor in decreasing adult mortality.

Respiratory Diseases

The poultry maladies affecting the breathing apparatus and formerly known under the terms *simple cold, bad cold, fall cold, roup, canker, bronchitis*, etc. have been resolved into several distinct diseases; their nature can be recognized by careful laboratory examination, although the clinical symptoms may be similar and overlapping.

Coryza

Infectious cold or coryza is probably the most prevalent respiratory disease and may affect birds of all ages.

The cause is a minute rod-shaped germ (*Hemophilus gallinarum*) which cannot live outside the body for any length of time but survives in the nasal passages of recovered birds and thereby produces carriers.

SYMPTOMS AND LESIONS. Often fatal in young chickens, coryza brings about a severe drop in egg production in the laying house, ordinarily followed by rapid recovery of the flock. Affected birds show difficult breathing, swelling of the cheeks and wattles, moist eyes, and discharge from the nostrils, especially on pressure.

On opening, these symptoms are found to be due to mucous exudate in the nose and upper windpipe; in protracted cases air-sac infections are not uncommon.

No specific *treatment* is known, and an attack of the disease does not confer immunity to subsequent ones. The best procedure is to do everything possible to encourage feed consumption and to keep the birds' quarters warm and well ventilated. Whenever possible, the

use of artificial heat in the laying quarters proves a helpful measure. Adding enough cod liver oil direct to the surface of the drinking water to form a film upon it is suggested by some authorities.

Infectious Laryngotracheitis

This is a serious form of the respiratory diseases, affects primarily birds in the laying house, and is accompanied by a severe drop in egg production and by high mortality. Recovered birds remain carriers, probably for life.



Figure 4.
Bird Stricken with Laryngotracheitis.

CAUSE, SYMPTOMS, LESIONS. It is caused by the specific filterable virus of laryngotracheitis. In typical acute cases birds show severe difficult breathing accompanied by rattling sounds and blood coughing. In milder cases the symptoms may be those of a severe cold.

Post-mortem diagnosis is based upon finding the characteristic foamy hemorrhagic exudate in the windpipe; other cases may show eye affection, yellowish adherent membranes over the entrance to the voice box or similar molds or cores of exudate in the windpipe. Death is due to suffocation.

TREATMENT. In addition to what has been said under coryza treatment, an emergency vaccination at the beginning of an outbreak is suggested;

this is based upon the knowledge that one attack of the disease, either in the windpipe or the mucous tissues of the vent, confers a permanent immunity to laryngotracheitis within five to ten days.

EMERGENCY VACCINATION. In the case of an outbreak in a small flock, or if birds scattered through the whole of a large flock show symptoms of the disease, vaccination will not be effective. If the flock is large and in several different pens and the disease has appeared in only a few pens, then some protection may be gained by vaccinating the balance of the flock immediately. If there is no question as to the diagnosis and time permits, use commercial laryngotracheitis vaccine; otherwise, home-made vaccine. Before doing so, acquaint yourself with the state requirements for a permit. If complicating diseases such as coryza and fowl pox are rampant in the flock, the results of vaccination are disappointing.

To prepare the home-made vaccine, kill a bird (one for every 150 to 200 to be vaccinated) with severe symptoms; take out entire windpipe, slit open, and pin on soft board; scrape out exudate, put in mortar, add few grains of sand and rub into fine paste, add one teaspoonful of salt-water-glycerine (one teaspoonful of table salt to one pint of water, boiled and cooled, plus one pint glycerine) and mix thoroughly. This constitutes the vaccine which is to be rubbed onto the upper part of the mucous tissues of the vent with a small-bristled brush.

Throughout the procedure clean utensils (boiled and cooled) should be used, the vaccine container kept in crushed ice, and the material itself made fresh every day.

CONTROL. To prevent the introduction of the disease, follow the ten-point program of "Do's and Don't's" on page 155.

If the disease has occurred in a flock, the poultryman should decide on a definite program of either eradication or vaccination. In New England where the export business of the poultry industry is based primarily upon quality and freedom from disease, the eradication plan should be the goal.

The eradication plan entails either immediate disposal of the entire stock or disposal of old recovered or vaccinated birds in the late summer about one to two months *before* the fall housing. The young unaffected stock must have been reared in strict quarantine under separate attendance.

The vaccination plan comprises the annual vaccination with commercial vaccine of all birds when they become six to eight weeks of age. If done properly, no carriers should be produced, but one cannot be absolutely certain on this point.

Infectious Bronchitis

This disease has been recently recognized as a severe respiratory disease of baby chicks (chick bronchitis) but is also a factor in older birds. It is caused by the specific filterable virus of infectious bronchitis. Its name is not to be confused with the former popular term for laryngotracheitis.

SYMPTOMS AND LESIONS. The disease is accompanied by the familiar symptoms of cold and drop in egg production. In chicks it may appear soon after hatching. The lesions consist of increased, sometimes blood-tinged, mucus in the nose and lower windpipe and grayish to yellowish thickening of the lung air sacs.

TREATMENT should be attempted along the lines suggested for coryza (page 167) and in older birds by emergency vaccination with home-made vaccine (see top of this page).

Fowl Pox

Fowl pox is the best-known disease of the respiratory group and is caused by the specific virus of fowl pox.

The dry form manifests itself on the comb and wattles by grayish "pox" nodules which become yellow to brown, confluent, and form massive crusts. This is by far the most common type.

The wet form tends to occur as a cold-weather disease, is characterized by yellowish adherent patches in the mouth and gullet and accompanied more or less by the symptoms of an ordinary cold.

Transmission takes place by direct and indirect contact, infected houses, and mosquitoes, but as far as known, recovered birds do not remain carriers for long.

CONTROL. In known infected premises and territories, vaccination with potent state or commercial fowl-pox vaccine is effective and harmless if applied to healthy vigorous birds between two to three months old. The simplest method is to punch the web of the wing with a sewing-machine needle dipped into the vaccine suspension.

For an outbreak in the laying house, pigeon-pox or fowl-pox vaccine and local treatment with tincture of iodine is suggested, but untoward reactions may be expected.

Nutritional Roup (Vitamin A Deficiency)

In adult birds the disease manifests itself by watery eyes which bulge at times with cheesy exudate. On account of these symptoms, the disease may simulate the presence of an infectious respiratory disease. In dead birds rows of swollen whitish nodules (glands) are found in the gullet.

Nutritional roup is due to lack of green food, cod liver oil, yellow corn, or other vitamin-A-rich ingredients in the feed. Wirthmore Feeds contain an optimum quantity of vitamin A and give adequate protection against this trouble.

Fowl Paralysis, Big-Liver Disease and Tumors

Tumors and tumorlike conditions are probably responsible for the greatest part of adult poultry mortality in the United States according to a recent survey. This likewise holds true for New England.

From the practical standpoint these diseases, except for certain rare tumors, are considered a complex unit because:

1. They are characterized by abnormal tissue growth.
2. They are caused by filterable viruslike agents.
3. Their occurrence is influenced by hereditary factors.
4. The known control measures are the same.

Fowl Paralysis

Fowl paralysis or range paralysis affects birds primarily during the growing period, but has been observed between the ages of four weeks and one and one-half years.



Figure 3.
An Acute Case of Fowl Paralysis.

The initial symptoms of incoordinated gait or clawlike position of the toes may quickly progress to droopy wings, complete paralysis of one or both legs, and prostration; cases of twisted neck, large watery crop, gaping (suggestive of a cold) and blind "pearly" eyes often occur in affected flocks.

On post-mortem examination of uncomplicated cases, the internal organs appear normal. The characteristic lesions are usually seen in the large nerve trunks of the legs and wings which show thickening

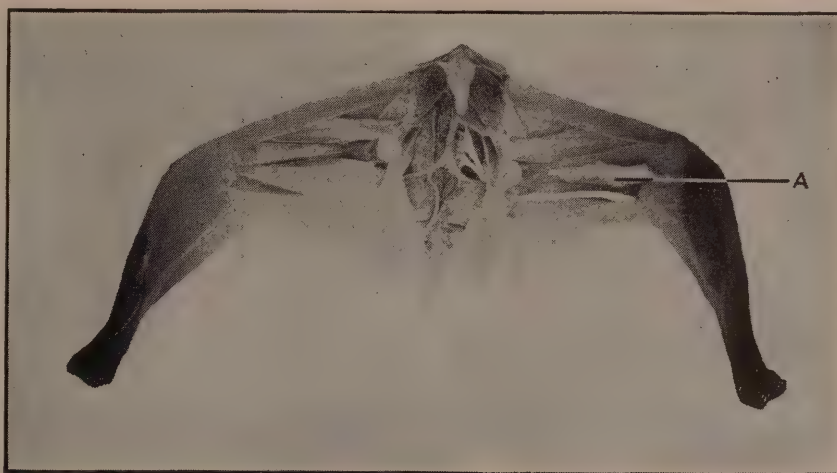


Figure 6.
Location of leg nerves to be examined in suspected fowl paralysis. The triangular muscle "A" is lifted up in left leg to show the white nerve underneath.

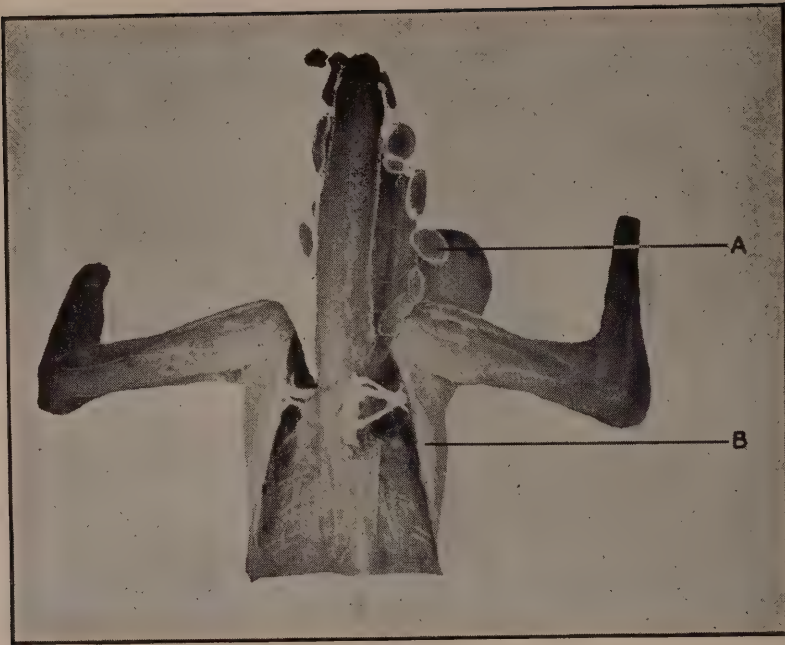


Figure 7.
Location of shoulder nerve to be examined in suspected fowl paralysis:
A. Lobe of the sweetbread gland.
B. Right shoulder blade.

and grayish discoloration. The ovary, rarely the testicles, are apt to show grayish tumorlike enlargements.

Big-Liver Disease

Tumorlike enlargements of the liver are a manifestation of a blood disease in the fowl known as leukosis or leukemia. Birds may die suddenly without preliminary symptoms, or show pale combs and diarrhea.

The post-mortem alterations are subject to wide variation according to the organs affected. Grayish nodular or general enlargements occur in the liver, spleen, kidneys, heart, or ovary; the nerves may be thickened as in fowl paralysis.

Big-liver disease and fowl paralysis are closely related conditions and may be only different manifestations of the same disease. This conception has been reached on the basis of transmission experiments in which big-liver disease was produced with infective tissues from fowl paralysis cases and vice versa.

Anaemia

Although some types of anaemia result from improper feeding or from parasites, a severe blood disease occurs in adult birds, accompanied by anaemia, "going light," and dark-red enlargement of the liver and spleen.

This disease is another form of leukosis, so-called erythroleukosis, and is considered by some to be caused by the same filterable virus that is responsible for fowl paralysis and big-liver disease.

Control of Fowl Paralysis and Tumorlike Conditions

Methods of control are incompletely understood and what is more have not excited the interest they should because only a few birds die at one time. Field and experimental studies suggest the following measures:

SELECTION OF THE PARENT STOCK FOR LOW INCIDENCE OF TUMORS AND DEMONSTRATED LIVABILITY. High tumor incidence in the parent stock seems to be followed by high incidence of similar conditions in the offspring and vice versa. Parent birds two years or older with demonstrated livability are likely to pass this livability factor on to the chicks. Under experimental conditions certain strains or families are much more susceptible to these diseases than are other strains or families.

RAISE REPLACEMENTS. The incidence of tumor diseases becomes progressively lower over a period of three to four years if no new blood is introduced. By breeding consistently from one-year-old to two-year-old survivors, some poultrymen have practically eliminated the trouble from the flock.

SANITATION. There is evidence that certain forms of these diseases spread by way of the droppings during the first 8 to 12 weeks of life. Avoid accumulations of filth and follow sanitary program as previously recommended.

COCCIDIOSIS AND WORMS. Although no direct relation to tumorlike diseases has been demonstrated, parasitic injury to the intestine may open an avenue of entrance for the causative agent.

LICE AND MITES. Experimental transmission of the diseases has been accomplished by the injection of minute quantities of blood. Blood-sucking insects do essentially the same thing. Common red mites have been shown experimentally to transmit fowl paralysis and allied conditions.

MINOR OPERATIONS in which insufficiently cleaned instruments are used on a large number of birds could transmit small quantities of blood. This possibility has been substantiated for the ordinary "stick" method used in fowl-pox vaccination. Frequent dipping of tools in alcohol and burning them off is suggested.

TREATMENT is of no avail. Affected birds should be eliminated; paralyzed birds in good flesh are not harmful for human consumption. A regular Epsom salts flush in the drinking water for one day at the rate of one pound per 100 birds seems to lower the incidence.

Internal Parasites

The worm problem is one of the oldest worries of the poultryman, but its importance has been greatly reduced in New England by range sanitation. Mild infestations are common in every flock. Before going in for wholesale worm treatment, the type and extent of the infestation should be determined (see page 154, "Field diagnosis").

Roundworms

Different species of roundworms live in the crop, glandular stomach, gizzard and intestine and cause damage either by taking food away

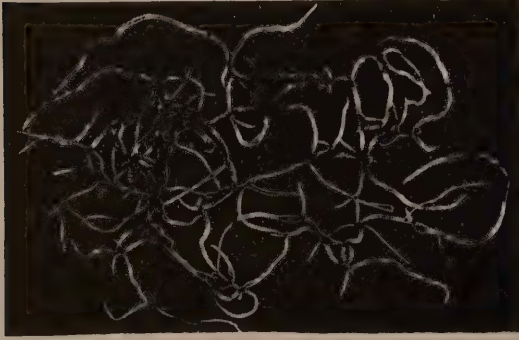


Figure 5.
Roundworms Frequently Found in the
Intestinal Tract of Poultry.

from the host, toxin formation, or burrowing into the wall of the digestive tract. Roundworm eggs pass out in the droppings and after a short period of incubation become directly re infective to birds. Fully developed eggs are hardy and may survive for several seasons.

The large roundworm is one to three inches long and lives in the small intestine. Heavy infestation before the age of

100 days causes general unthriftiness and intestinal irritation; older birds are comparatively resistant to the effects of the invasion.

Individual treatment with tetrachlorethylene in capsules, with nicotine capsules, with Iodine Vermicide which requires the use of a catheter or a flexible rubber tube, or flock treatment with standardized tobacco powder, is effective.

HAIR WORMS, sometimes called microscopic roundworms, are a problem in some sections of New England. Although up to one-half inch in length, they are thin, live embedded in the mucus of the small intestine, and thus may escape detection. Individual treatment with tetrachlorethylene as for large roundworms is recommended.

The *pinworm* is about one-half inch long and lives in the blind guts. Young infested birds show thickening, hemorrhages, and small nodules in the affected intestine, while damage in older birds is negligible.

Due to their location, the only known treatment is injection into the vent (with hard rubber enema syringe) of five cubic centimeters bland oil containing one-tenth of a cubic centimeter oil of chenopodium.

Tapeworms

Tapeworms are segmented whitish flatworms which range in size from one-quarter inch to four inches according to the species. The small so-called microscopic tapeworms are especially harmful.

The tapeworm head remains attached to the mucous membrane of the intestine and continues to produce body segments of which the mature ones pass out in the feces. For further development the ripe eggs in the segments must be picked up by flies, slugs or beetles (depending

on the species) which serve as intermediate hosts and are in turn eaten by the birds.

TREATMENT is not entirely satisfactory because no drug is known to remove all tapeworms, including their heads. Kamala in one-gram tablets, or Iodine Vermicide applied with a catheter or a flexible rubber tube is suggested. Combination treatments for roundworms and tapeworms are less effective, but may fill the bill in mild cases.

Control of Internal Parasites

Worm treatment by drugs should be considered a supportive measure to sanitary control.

For roundworms it is important to protect the birds during the most susceptible period, the first three months of life. Early hatches, long confinement to the brooder house, and range sanitation are valuable from this standpoint.

Tapeworm control is more difficult and must be directed against the intermediate hosts. Fly control by screening and repellents, removal of old feed bags from the houses (meal beetles!), sanitary disposal of waste products and of other insect-breeding places are essential features.

External Parasites

Aside from the annoyance caused to birds by parasites which live on the body surface, blood-sucking habits of some may be responsible for loss in egg production, anaemia, and perhaps transmission of tumorlike diseases.

Lice

Lice spend their entire life on the body of the host. The different species vary in tempo of movement and body surface inhabited. Lousiness can be easily detected by examining the skin surface just below the vent. The eggs or nits are found glued to the down feathers. TREATMENTS should be applied twice, seven to ten days apart, in order to destroy the newly hatched parasites.

The treatment commonly used consists of a forty per cent nicotine sulphate solution such as "Black Leaf 40." There are numerous of these products available commercially. The solution is applied with an oil can or paint brush to the top of the roost about one-half hour before birds go to roost. The fumes evaporated by the body heat of the birds kill the lice.

Mites

The life habits of these parasites vary with the species and have to be taken into account in their control.

The common *red* or *gray mite* reproduces at an enormous rate during warm weather and causes irritation and weakness by its blood-sucking

activities. It lives under boards in nests and cracks and attacks at night.

These hiding places must be painted with any good red-mite killer such as carbolineum or creosote oil. Crank-case oil mixed half and half with kerosene may be used but is not so satisfactory.

The *northern fowl mite* or feather mite has lately caused some losses. In distinction from the red mite, this parasite does not leave the bird. Naphthalene ointment (ten per cent) or a nicotine sulphate solution painted on the roost is suggested. Pens should be sprayed with ten per cent tar-oil emulsion.

The small *depluming mite* burrows itself into the skin near the base of the feathers; control by use of nicotine sulphate solution painted on the roosts, or local application either of carbolated vaseline or lard and sulphur half and half.

The *scaly leg mite* is the cause of scab formation on the shanks and can be treated by dipping the affected parts in kerosene after softening the scales with soapsuds.

Diseases of the Egg-Laying Apparatus

Aside from infectious diseases such as pullorum disease and fowl cholera which may localize in the reproductive organs, laying hens suffer from nonspecific disorders in the egg-laying apparatus.

BLOOD AND MEAT SPOTS in fresh eggs are due to small hemorrhages in the ovary or oviduct before the egg is formed. Rations adequate in minerals and vitamins, such as Wirthmore Feeds, go a long way in preventing this trouble.

SOFT-SHELLED EGGS are usually due to the fact that the supply or assimilation of lime is insufficient for proper functioning of the oviduct. What has been said in the prevention of blood spots is here applicable. Shell-making material in excess of that present in a normal mash should always be available either in the form of oyster shells or limestone grit.

FISHY EGGS lead to trouble with egg purchasers. The condition occurs usually in the eggs from certain birds, becomes more noticeable on storage, and cannot be corrected except by eliminating the offending birds. As far as known, a hereditary rather than a feeding factor is responsible.

Cannibalism and Prolapse

These conditions occur often together and should be corrected by the same measures. Flock problems of "picking" and weakness of the vent muscles leading to "blow-outs" are complex and need careful analysis in each case.

Contributory factors to these troubles are intestinal diseases, crowding, insufficient hopper and fountain space, idleness, close confinement, overheating, floor laying, injuries, and malnutrition.

Failing to prevent cannibalism by giving thought to the foregoing points, the poultryman should resort to the following *emergency measures*:

1. Tip the beaks. Use pick guards or specs.
2. Watch the flock from a vantage point and remove the worst offenders.
3. Darken the houses and use ruby-red lights or red window paint.
4. Treat injured birds with a mixture composed of two ounces pine tar, one ounce bitter aloes, and tincture of iodine sufficient to make a paste.
5. Move hoppers and fountains frequently; place pine boughs in the houses for amusement and distraction.
6. If feeding scratch grain, reduce yellow corn and substitute oats.



Poultry Service Department

THE ACTIVITIES of the Wirthmore Poultry Service Department are planned on the basic idea of being helpful to New England poultrymen. Long ago we learned that aiding poultrymen with their problems aided us, indirectly, with our own. The steady growth in Wirthmore tonnage comes not only from making good feeds but by helping users get the most out of them. And that involves practically every phase of poultry management.

Whenever you have questions relative to poultry feeding or management they will be gladly answered if you will write direct to whichever one of the eight men *first listed* below is located nearest you. He will reply personally and without cost to you. This service is in no way limited to Wirthmore users.

To avoid delay, please be sure to confine your written inquiries among the eight men whose names and addresses are first listed (those in larger type). Any requests for service visits should be placed with your local Wirthmore distributor.



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New, up-to-date and practical. See following page.

Poultry Houses and Equipment

The Wirthmore Poultry Service Department has assembled a new set of up-to-date, workable plans for building poultry houses of various types, range shelters, laying shelters, feed hoppers, etc.

These plans are each on a separate sheet, 10" x 14" in size, and are available in a complete set enclosed in a suitable binder. Any plan which the poultryman wishes to use or study can be quickly found and removed from the binder. In the event that additional plans are issued later they can be added to the set. Likewise any plans which may later become obsolete can be removed from the binder. The aim is to supply New England poultrymen with these plans in a form that is easy to use and which can be kept up to the minute in order to at all times reflect the best knowledge in the construction of poultry houses and equipment.

Any New England poultryman who has use for a set of these plans will be supplied as soon as possible, either by getting in touch with his Wirthmore Dealer or by writing direct to Wirthmore Feeds, Malden, Mass.

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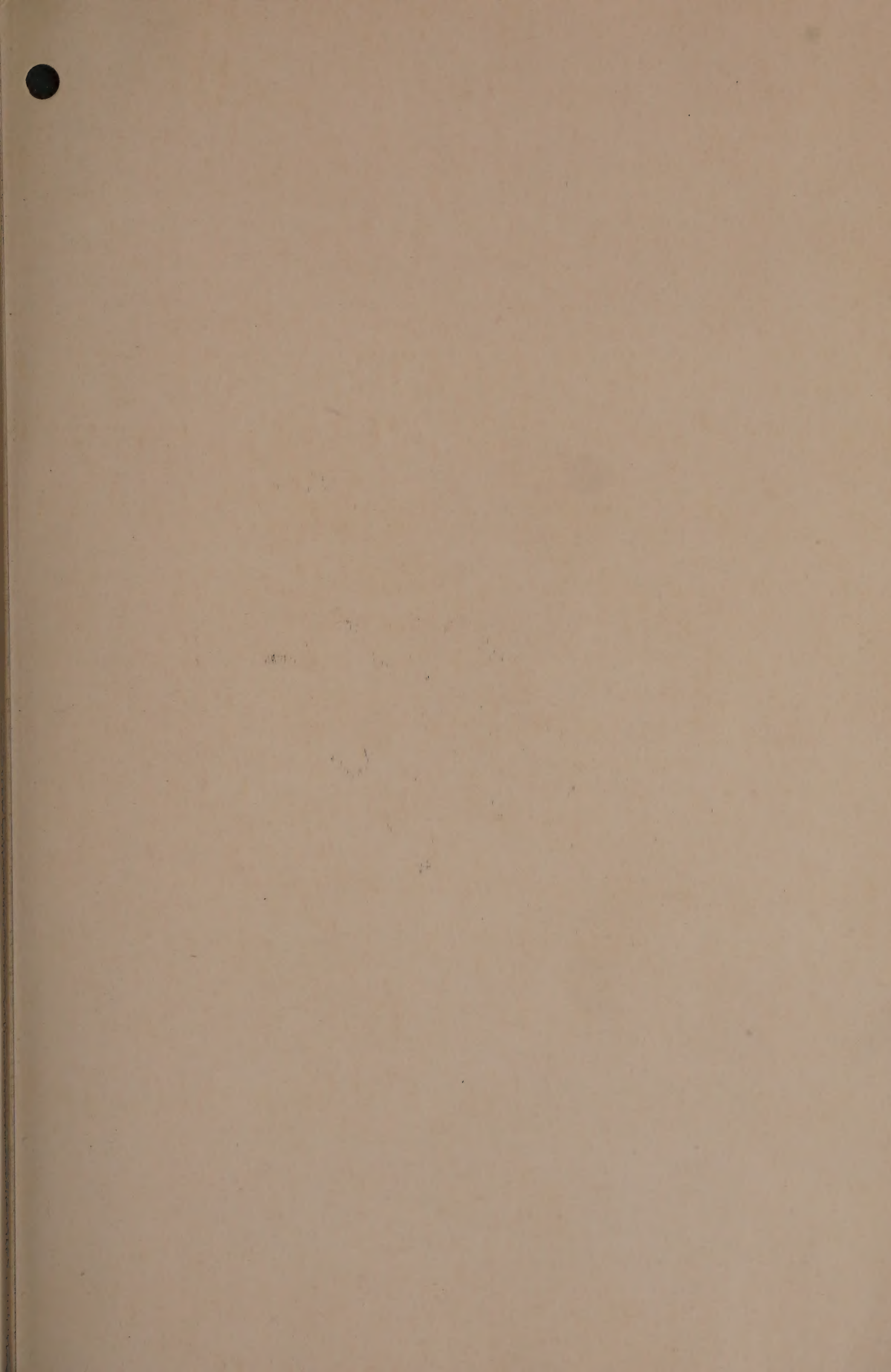
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Our Thanks

*W*E wish to express our sincere thanks to all who have so kindly cooperated in the preparation of the material in this book, and to acknowledge the courtesy of those who furnished us with several of the illustrations used.

It is a source of regret that space would not permit us to reproduce more of the many excellent photographs submitted to us.

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